OCTOBER

THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION AND THE DENTAL COSMOS

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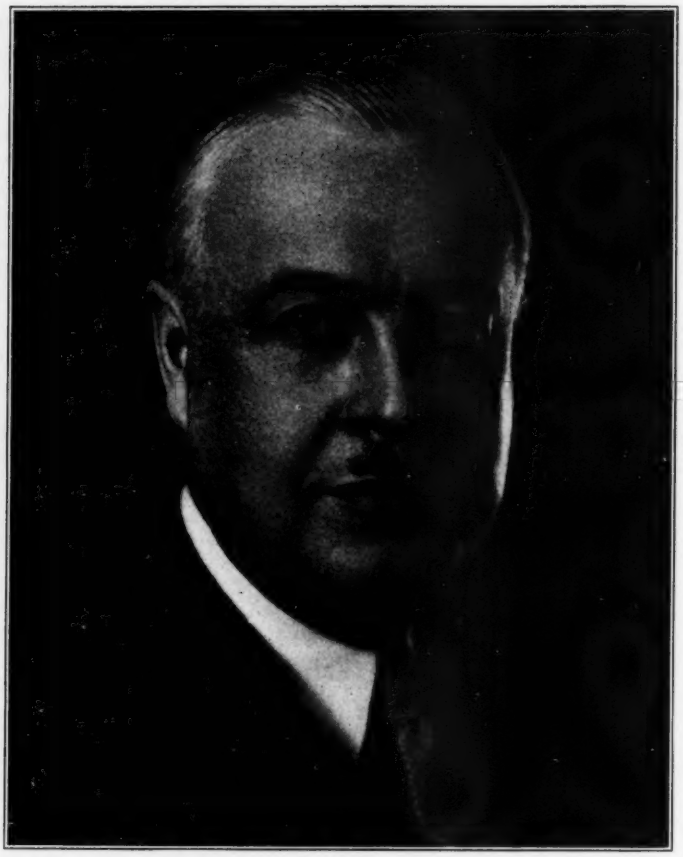

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THE JOURNAL *of the*
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CONNECTIVE TISSUE CHANGES ASSOCIATED WITH VARIABLE OCCLUSAL STRESSES

By G. R. LUNDQUIST, M.S., D.D.S., Chicago, Ill.

SINCE the origin of disease is usually related to two or more factors, for example, the immediate cause and the predisposition, which should be differentiated, it follows that an injurious agent is never the only factor in the disease process.

Maxwell[1] states that cusp interdigitation in lateral excursions of the mandible, as well as in the functional range from protrusive to centric, normal arrangements of the teeth and the normal relation of the denture result in an equitable distribution of masticatory forces. This signifies an equitable distribution of pressures and stresses in the supporting structures of all the teeth and implies that cusp interference in either lateral-to-centric or protrusive-to-centric movements may result in injury to certain of the peridental structures and possibly in disuse atrophy of others. As stated, this deals with but one factor in the disease process and implies that the injurious mechanical agent is dominant.

Noyes[2] states that connective tissue is formed in response to mechanical conditions and stimuli, and that, therefore, its arrangement should be considered, not as having been designed to sustain the forces, but as being the result of forces to be sustained and therefore beautifully adapted to them. This implies that the supporting structures can accommodate variable occlusal stresses.

Black,[1] in Volume 4 of his work on operative dentistry, defines a new term, "pressure pericementitis," as being applied to an inflammation of the pericemental structures, resulting from a lack of balance between the masticating force and its direction, on the one hand, and the resistance of the supporting structures, on the other. A consideration of such a disturbance seems to be in order.

As the changes which occur in the supporting structures during the tipping of a tooth or the movement of a tooth are largely confined to the pericemental structures, particularly bone, a review of the

(From the Oral Pathology Department of Northwestern University Dental School.)

(Read before the Section on Operative and Preventive Dentistry at the Seventy-Third Annual Midwinter Clinic of the Chicago Dental Society, February 17, 1937.)

factors in physiology of bone may be in order.

When bone is viewed from the standpoint of the general physiology of tissues, although it appears to be eminently stable, it seems to be engaged in a perpetual struggle to maintain itself. Leriche and Policard[8] have suggested that its rôle as a supporting structure may be of secondary importance, as is perhaps its function as a calcareous reservoir. They point out as of prime importance the fact that mechanical function seems to dominate bone.

This is possible because, as these authors state, calcium deposition in ossification is a colloidal deposit which is made in another colloid, the pre-osseous hyaline substance, and, moreover, mechanical forces, such as pressure and traction, are capable of modifying the deposition of colloidal substances.

The works of Oppenheim and Stuteville in the field of orthodontia demonstrate clearly that pressure applied to teeth with accurately measured forces that caused a tipping movement of such teeth resulted in resorption and proliferation of bone, the reaction varying with conditions.

Figures 1 and 2, of an upper first bicuspid in the mouth of a boy fourteen years of age, represent the changes which take place in the pericemental structures on the pressure and traction side of the tooth root, respectively, when mild pressure is maintained for a time without tipping the tooth sufficiently to make pressure contact against the bone.

Figure 1 shows the peridental membrane and bone in the buccogingival region, or pressure side. Osteoclastic activity is noticeable on the peridental membrane

Fig. 1.—Resorption of bone in the buccogingival region (upper first bicuspid), or pressure side. R to R, region of bone resorption, with osteoclastic activity along this border. Bone is indicated by G; peridental membrane, P; cementum, C, and dentin, D. (Stuteville.)

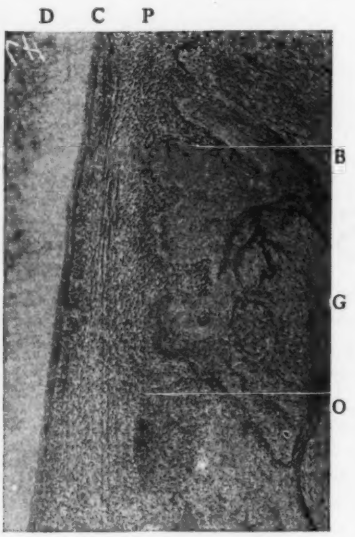


Fig. 2.—Development of new bone in the linguogingival region, or traction side. Old bone, G; new bone, B; peridental membrane, P; cementum, C, and dentin, D. (Stuteville.)

surface of the alveolar process. No cementum resorption is in evidence. The region of bone resorption extends from R to R. Osteoclasts are clearly visible along this border. Bone is indicated by G; peridental membrane by P; cementum by C, and dentin by D.

Figure 2 shows the linguogingival region, or traction side. Here, traction seems to be the predominant factor in determining the arrangement and direction of peridental fibers. This also applies to the new bone adjoining these fibers. The old bone is marked G; the new bone, B.

Fig. 3.—Pericementitis developed by orthodontic force sufficiently strong to press tooth against buccogingival alveolar crest in mouth of girl fifteen years of age. Resorption of bone, cementum and dentin at point T; resorption of bone at R; bone, G; peridental membrane, P; cementum, C, and dentin, D. (Stuteville.)

Figure 3, photomicrograph of a tooth and a portion of alveolar process from the mouth of a girl fifteen years of age, illustrates some of the changes which take place when there is a force sufficiently strong to press the tooth against the buccal alveolar crest. In this case, the force was active for a period of twenty-nine days and was still operative when the biopsy was performed. The peridental membrane is necrotic in the region of the labial alveolar crest. There is an undermining resorption involving the bone and the adjoining portion of the cementum and dentin of the tooth root at the point T. Below this region, at R, may be found another active resorption reaction. The bone is G; the peridental membrane, P; the cementum, C, and the dentin, D.

Figure 4 illustrates the repair process

Fig. 4.—Repair process on pressure side during rest period in case in which experiment similar to that represented in Figure 3 took place. Deposition of secondary cementum or bone at S; new bone, B; old bone, G; peridental membrane, P; cementum, C, and dentin, D.

that was in progress in the supporting structures on the pressure side during a rest period of twenty-eight days after a previous pressure resorption had been reestablished six times at fourteen-day intervals. The normal width of the

peridental membrane space is being redeveloped by the deposition of secondary cementum or bone on a portion of the resorbed region of the root surface at S, and by the building in of new bone at B. The old bone is marked G; the peridental membrane, P; the cementum, C, and the dentin, D.

These instances indicate that pressure and traction may be deemed excitants of bone growth.

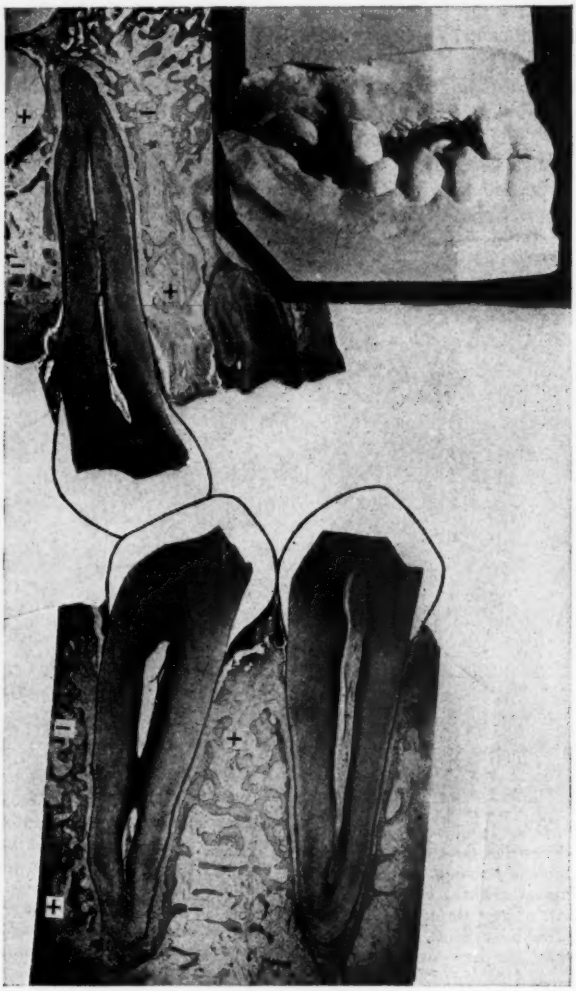


Fig. 5.—Effect of force of occlusion tipping upper second and lower second bicuspids mesially. Pressure regions are indicated by the plus signs; traction regions by minus signs. (Black's Operative Dentistry, 1936.)

In these cases, pressure seems to de-

termine an augmentation of the circulation, resorption of bone and a probable local calcium excess. When the pressure ceases, new bone is likely to be formed because of the antecedent resorption and local calcium excess. The pressure seems to act by preparing the proper medium for the laying down of bone. The latter process operates only in the absence of pressure. Therefore, in young persons subject to these experiments, alternation of periods of pressure and repose made the apical portion of the root compresses the peridental membrane on the opposite side of the root. These are called regions of pressure. At the same time, the peridental membrane fibers are drawn taut in the region of the alveolar crest on the side opposite the pressure, and the same condition prevails near the apex of the root on the side of the socket from which the apex moves. These are called regions of traction.

Figure 5 illustrates the effect of occlusal

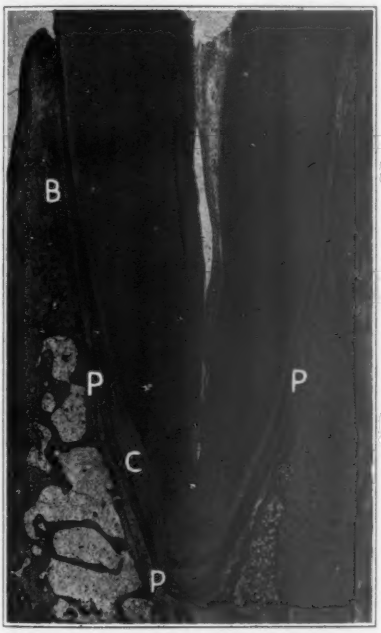


Fig. 6.—Buccolingual section of lower right second bicuspid not in occlusion. Bone, B; peridental membrane, P, and cementum, C.

Fig. 7.—Labiolingual section of upper central incisor in functional occlusion. Pressure regions, plus signs; traction regions, minus signs; bone, B; peridental membrane, P, and cementum, C.

for a change of the position of the tooth coincident with resorption and the rebuilding of bone to accommodate the demands of mechanical forces.

In the application of force which tends to tip a tooth within its socket, the gingival portion of the tooth is moved toward the alveolar crest in one direction, while

stress applied in the mesiodistal plane. Above and to the right is a plaster model of the upper and lower jaws,* with the upper and lower teeth in their occlusal

*Supplied by Emil Mueller. The tissue sections were prepared by William G. Skillen.

relation. Below, to the left, will be found the occluded upper and lower second bicuspids, to which the outline of the enamel of the crowns has been added in approximately the same relation as existed in the mouth. The pressure regions are indicated by the plus signs; the traction regions, by minus signs. The effect of the force of occlusion is to tip both teeth mesially.

When pressure is applied to teeth with accurately measured forces for definite periods, as, for example, in the orthodontic cases reported above, resorption of bone occurs. If pressure is followed by an interval without pressure, usually co-

Fig. 8.—Bicuspids and molars, showing adjustment of supporting tissues to variable functional demands. Normal bony structures about the lower bicuspids and first molars; increased density of bone about first molar; cancellous bone about second molar.

incident with the use of retainers, there is proliferation of bone in the exact place where pressure had exerted its effect. In these cases, a tipping stress sufficient to produce a thrombosis of the peridental blood vessels, a necrosis of the affected portion of the peridental membrane and resorption of bone farther distant from the center of tissue injury often takes place. Absence of pressure makes for rapid repair in these young persons.

Under physiologic conditions, the peri-cemental structures of the normal healthy adult are capable of similar though somewhat modified adaptive changes. Histologic sections of tissue attest to this fact by demonstrating repairs in both cementum and bone in regions of previous injury. Normally, then, the processes of resorption and repair are kept in harmony. When external forces do excite reaction in bone, they throw their weight to either one side or the other of the

Fig. 9.—Labiolingual section of upper central incisor representing early stage of change. The pressure regions are to the labial side near the crest of the process and to the lingual side near the apex. The traction regions are exceptionally well shown to the labial near the apex and to the lingual near the crest of the process.

equation. Variable changes are observable, depending on the resistance of the subject and the type of stimulation.

In the absence of function, as for ex-

ample, in non-occluding teeth, usually no cementum resorption occurs. Instead, the cementum may increase in thickness, while the peridental membrane becomes narrower and may become atrophic. The adjoining bone often becomes cancellous in appearance. This is a perfectly normal adjustment to lack of functional demand.

Figure 6 illustrates a buccolingual section of a lower right second bicuspid not

Fig. 10.—Labiolingual section of upper incisor representing further progress, resorption in pressure regions and less rebuilding of bone in traction regions.

in occlusion. As compared to the peridental membrane space of a functional upper central incisor, illustrated in Figure 7, this space is narrow. The bone surrounding the apex beyond the alveolus is cancellous. As this non-functional tooth emerges occlusally, a compensatory building of bone at B and cementum at C is taking place. As a result, the narrow peridental membrane space is maintained.

Figure 7 illustrates a labiolingual section of an upper central incisor in functional occlusion. Here, the peridental membrane space, of fairly uniform width, is wider than that in Figure 6. The pressure regions (plus signs) and the traction regions (minus signs) are slightly wider than the intervening regions. Nevertheless, the restoration of bone seems to balance the resorption process. Hence, we have a sound functional tooth capable of withstanding occlusal, or incisal, and interproximal wear.

Increasing function, on the other hand, may cause a change characterized by an increased density of bone. Figure 8 is a roentgenogram of a series of upper and lower teeth in occlusion which represents changes in the supporting structures accompanying variation in occlusal functional demands. Occlusal and interproximal wear attests to the vigorous use of all the teeth with the exception of the lower third molar. Physiologic resorption and recession of the gingival tissues, leaving no pockets, have occurred. The bone supporting the bicuspids is of good structure as a result of active use of these teeth, which were in normal occlusion. Particular attention is called to the fact that the distal half of the occlusal surface of the upper first molar makes contact with the mesial half of the occlusal surface of the lower second molar; and since the upper second molar is missing, the tendency is to tip the lower second molar mesially. In the case of this normal healthy person, the close proximal contact of the lower first and second molars retarded the mesial movement of the tooth. Nature's reaction to this force is expressed in an increased density of bone in the apical region on the distal side of both roots of the lower second molar. Hence, increasing the functional demand has tended to strengthen rather than to weaken the supporting structures. Since

there is no functional need for dense bone around the lower third molar, which is not in occlusion, the adaptation to this is cancellous bone. Here, then, we have an excellent adjustment to variable functional demands: normal bony structures accompany normal functional demand; increased density of bone is found associated with increased functional demand, and definitely cancellous bone occurs in the absence of functional demand.

Attention is called to the fact that such injury to the pericemental structures of a healthy person is traumatic in effect. It should be considered as an aseptic wound or a process of inflammation in its simplest form, and is complete only when a series of events which we call repair have occurred. Furthermore, only certain regions of pressure and traction participate in the process. The tooth usually survives such minor injuries.

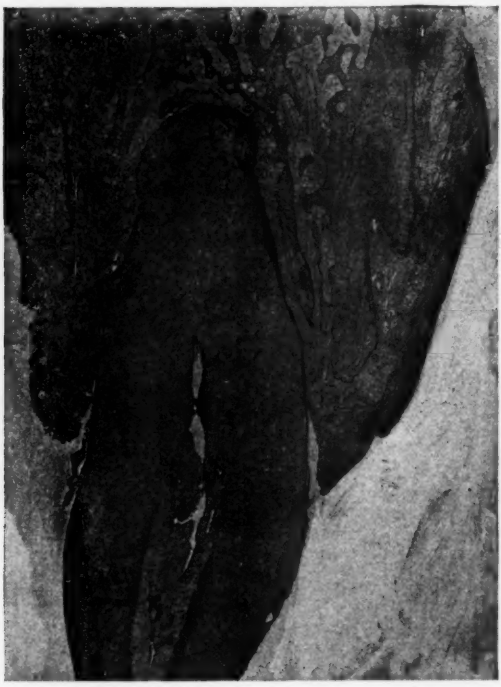


Fig. 11.—Labiolingual section of upper central incisor representing almost complete loss of labial process with replacement fibrosis.

These reactions, illustrated in Figure 8, took place in the mouth of a healthy person. The increasing functional demands were not excessive in this case, but in the case of a person of less vigorous reactive capacity, they might become excessive and cause injury to the pericemental structures.

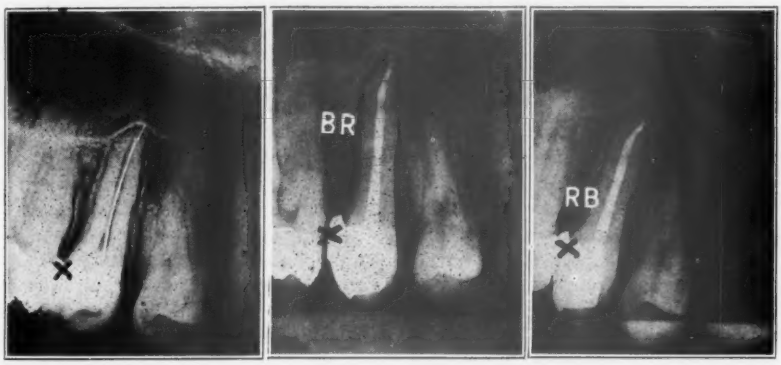
In patients of low resistance, especially those suffering from metabolic disturbances, sufficient stress may produce a thrombosis of the peridental vessels and necrosis of the affected portion of the peridental membrane and the adjoining bone. In such cases, with an improvement in general health after the necrotic pieces

of bone and blood coagulum are resorbed, normal restoration might occur, as indicated by findings after similar injuries in the mouths of healthy persons.

However, it should be stated that a lack of normal resistance, which would limit movement of teeth, may be indicative of a disturbed metabolism. Such a condition may be characterized by uneven occlusal and irregular interproximal wear, or it may be characterized by the presence of loose teeth incapable of such adjustments. As a result, an increase in leverage on individual teeth may occur.

Such a functional excitation brings on an augmentation of cellular functions, increasing the circulation to the reactive regions, especially those of pressure. Under such conditions, bone resorption takes place without a sufficiently rapid replacement. As a result, an increase in the width of the peridental membrane in the pressure and traction regions becomes evident. Here, then, Nature's adaptation to increased stress is expressed as a functional hypertrophy of the peridental membrane. A replacement fibrosis of the peridental membrane takes place. Figures 9-11 represent changes in the supporting tissues accompanying variable stress demands. The bite was such that these teeth were all being tipped labially, similarly to the anterior teeth of the cast in Figure 5.

Figure 9 represents an early stage of change, indicated by a widening of the peridental membrane in the pressure and traction regions. In the pressure regions, labiogingival and apicolingual, the peridental fibers are relaxed, with the result that the blood, nerve and lymphatic vessels take on a circular arrangement; whereas in the traction regions, linguogingival and apicolabial, such vessels appear ovoid as a result of tension. Bone is being resorbed in the pressure regions, and some is being rebuilt in the traction regions. Noticeable also is the new bone being laid down in layers labially to the labial alveolar process to reinforce it against complete resorption and thus prevent too rapid labial tipping of the tooth.



a *b* *c*

Fig. 12.—Roentgenograms taken at different time intervals. Seeming development of pocket, *a* and *b*; bone resorption, BR; regeneration of bone, RB.

Figure 10 represents further progress of resorption in the pressure regions and less rebuilding of bone in the traction regions. In addition, the labial alveolar bone is rapidly being resorbed on its inner surface, while bone is being built on the outer surface, this process allowing for a replacement more nearly horizontal with a further tipping of the tooth.

Figure 11 shows an almost complete loss of the labial process, with a replacement fibrosis maintaining its attachment to the tooth almost to the same height as in the lingual tissues.

Such conditions may allow for more individual tooth movement. Attention is called to the fact that only teeth with sound pericemental structures can be worn off occlusally and proximally in the act of mastication, the leverage action on such teeth being thereby reduced. Hence, in those cases wherein more individual tooth movement is allowed, the intervals between the application of pressure and repose are so short that the pressure acts as though it were more or less continuous. This brings the movable tooth to a new position in occlusion. Overstress under these conditions may become effective, as overstrain, which is a pathologic effect wrought by activity. Under such conditions, the case is not improved by exercise. Such a tooth actually becomes less capable of responding to a given demand, so that it may drift out of occlusion and become stable, since rest is effective under such conditions. Again, such a tooth may be continuously injured as the teeth are occluded. In this case, to relieve the excessive occlusal stress may not be sufficient. In the orthodontic experiments reported, we noted that resorption of bone ceased and it was rebuilt on cessation of pressure coincident with the use of retainers. In both cases, destruction of certain pericemental structures occurred. It can be expected that the use of splints or fixed bridges to limit undue movement of the teeth may have a similarly beneficial effect in the mouth of an adult.

Changes occurring in the tissues and associated with variable degrees of stress should be considered separately from those due to inflammatory processes associated with gingival injuries and the presence of pericemental pockets, which as a rule are infected.

Figure 12 shows three roentgenograms taken at different time intervals. The first and second seem to show the development of a very deep pocket with considerable loss of bone. The third one, to the right, shows a complete regeneration of the bone and seemingly a reattachment. As a matter of fact, exploration of the gingival crevices, with a peridental membrane explorer, during this course of events showed that no pocket ever developed, and the peridental membrane attachment remained approximately at the enamel-cemental junction. It was simply a matter of bone resorption induced by the inflammation in the overlying gingival tissues. On removal of the cause of the inflammation (an overhanging filling with accumulated débris), the bone was rebuilt in the region of the connective tissue attachment.

In the latter cases, the inflammatory process demonstrates the characteristic reaction to infection, largely absent in the stress injuries, which are, so to speak, aseptic injuries, or inflammation in its simplest form indicating the possibility of rapid repair.

The inability to recognize these individual and distinct lesions has led to a considerable number of misinterpretations. It should be noted that in the case showing advanced resorption of bone with a replacement fibrosis of the pericemental structures, the pocket is comparatively shallow. (Fig. 11.) Attention is called to the center photograph of Figure 12. Here, the bone resorption was induced by an inflammatory reaction going on in the overlying gum tissue. It follows that roentgenographic evidence would be similar in the two cases. (Figs. 11-12.) The stress injury (Fig. 11), because of the large amount of connective tissue attachment, should improve as a result of stabilizing the tooth; while the other (Fig. 12) improves as a result of inducing cleanliness in order to control the gingivitis. If the lesions involving the investing tissues in the regions of pressure and traction were the prime etiologic factor in pyorrhea, such pockets (as are shown in

Figure 11) should be considerably deeper. One does not doubt, however, that the mobility of the tooth might predispose to gingival injury or aggravate it after injury has occurred.

It follows that the pocket is probably never completely eliminated; nor does the flow of pus from such a pocket entirely cease as a result of merely correcting occlusion; but it may often be cured by treatment or elimination of the crevice without treatment of occlusion.

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180 North Michigan Avenue.

TREATMENT OF PERIDENTAL INFLAMMATION COORDINATED WITH PHYSIOLOGICAL REACTIONS OF THE TISSUES

By Arthur D. Black, A.M., M.D., D.D.S., Sc.D., Chicago, Ill.

THE structure and functions of the several tissues which compose the gingivae and peridental membranes were well described and illustrated by G. V. Black[1] fifty years ago; yet only during the recent past has consideration been given to the reactions of these tissues to injury and disease as a basis for the planning of treatment. Generally, treatment has consisted of the more or less thorough removal of deposits, followed by some form of medication, which might vary from physiological salt solution to the most severe caustics. The medication in a particular case might have been for the purpose of cleanliness, to allay inflammation, to destroy bacteria, to cauterize the tissues, to etch the cementum, etc. In the large majority of cases, the objective was to secure reattachment of the pocket tissue to the cementum, by the use of drugs, usually caustics; by scarification of the soft tissues, or by the removal of the outer surface, or more, of the cementum. Oftentimes all three were combined.

The lack of knowledge of the peridental tissues and their functions and the extreme injury to which they were subjected are well illustrated by the following excerpts from a paper[2] by a practitioner of considerable prominence, written in 1899.

After a local anesthetization of the affected tissues, "a thin chisel-shaped, flexible lancet" was . . . "carried down the side of the tooth to the alveolar process and passed all the way around the tooth, thus completely separating it from the overlying gum. . . . If no discoverable pocket be present," he said, "the lance is just as freely used." After access to the root was thus gained, he proceeded "to scrape and chisel heroically all around, especially about the part covered by the

(Read before the Section on Operative and Preventive Dentistry at the Seventy-Third Annual Midwinter Clinic of the Chicago Dental Society, February 17, 1937.)

1. "The Periosteum and Peridental Membranes." *D. Rev.*, 1:57, 113, 169, 233, 289, 353 and 411, 1886-1887.

2. Stewart, H. T.: *D. Cosmos*, 41:617, July 1899.

pocket." This was not "to be merely scraped sufficiently to remove the diseased part of the membrane," but the cementum itself was removed to a considerable depth. Then the overlying gum was "to be thoroughly lacerated, and diseased portions of the process removed."

And he proceeded, "Now, with a very sharp, fine-pointed excavator, fine grooves are cut in the cementum well down under the gum. The object is to afford a better place for deposit and attachment of new tissue. . . . These grooves are often cut with a small-size bur extending to a considerable depth below the alveolar process. Usually about four grooves are cut on each root. Into these grooves new bony tissue is soon deposited, and greatly tightens the tooth. . . . The pockets are now washed out and pure sulfuric or hydrochloric acid is applied with a platinoiridium wire, flattened at the point. This acid is repeatedly applied, wiping away the blood which oozes quite rapidly out of the wounded pocket. The object is to keep the acid in contact with the scraped part of the cementum long enough to decalcify the surface. I would emphasize the importance of doing thorough and heroic surgical work, as the medication is useless without it. Too much stress cannot be laid on the importance of thoroughly and deeply scraping the roots and lacerating the tissues. It is almost impossible to overdo it. Of course, we get violent inflammation, but that is what we want. . . . Scrapers should be stiff enough to allow considerable force to be used, and should cut like excavators."

It may be added that the treatment recommended in several articles, during the past five years, is no less radical than that quoted above. However, during the past twenty years, attention has been gradually focused more and more on coordinated histopathological studies in the development of more effective methods of treatment. It therefore seems appropriate to present a brief review of the functions and reactions of the various cellular elements of the tissues, as these are being used as a guide in determining the treatment to be employed.

Cases present with varying degrees of involvement of the supporting structures —from a mouth in which there is a single shallow pocket to one in which there is every degree of tissue change, including the most extensive destruction that can occur about the teeth while they remain in the mouth. In cases in which there are several pockets of considerable depth, there may be a history of one or two teeth that had been extracted because they became very loose or were tender to pressure; there will likely be other pockets of moderate depth and a few that are very shallow. In other locations, inflammation of the gingivae, without detachment of the peridental membrane, will be found. Any of these may be complicated by deposits of serumal calculus. The investing tissues about other teeth will be normal and may present the picture of perfect health.

These wide variations in conditions in the same mouth are expressions of the extreme chronicity of this disease. In cases in which several teeth have been lost, the complete history might cover twenty-five years or more. One should learn to visualize and understand this history in the examination of a single complicated case. Every type of the disease, from the slightest gingivitis to the tooth that has lost most of its supporting structures and is so loose that it might be removed with the fingers, may be seen in the same mouth. In some cases, in which the extraction of teeth was too long delayed, there is evidence of even further injury, as shown by the excessive destruction of bone, which has left the patient without a sufficient residual alveolar ridge to support a denture. In the study of cases and the planning of treatment, it is of the greatest importance that each tissue change, as seen about the various teeth, should be recognized as one more step in the progress of this disease as applied to each and

every tooth. The history of a quarter of a century for a few teeth is in process of repetition, in varying stages, about others.

All of these conditions may be very simply classified according to the tissues involved and the causes. Gingivitis is always a forerunner of pericementitis, and it must receive first consideration in treatment for the prevention of pericementitis. The principal causes may be classified as lack of cleanliness, deposits of calculus, injuries of various kinds and certain systemic diseases which particularly affect their histological structure. Immediately after passing the level of the crest of the bony alveolar process toward the crests of the gingivae, the epithelial covering of the gum tissue becomes thicker and stronger, with the cellular elements themselves smaller and more closely disposed. As this epithelium becomes thicker, the interdigitation of the connective tissues beneath, into the epithelial covering, becomes longer, more closely set and finer. The connective-tissue projections are reduced to fine strings, each of which in-

Fig. 1.—Section of a normal gingiva, showing epithelial covering and projections of connective tissue into the epithelium.

Fig. 2.—Section showing downward growth of epithelium of the gingival crevice, with attachment to the cementum.

these tissues. The gingivae have structural characteristics by which they are differentiated from other epithelial structures. In every part of the body, the epithelium is modified, in response to irritation and stimulation, to meet particular needs and thus perform its principal function of protecting the underlying connective tissue.

FUNCTIONS AND PHYSIOLOGICAL REACTIONS

The epithelial covering of the gingivae is one of the very important elements of

cludes a minute arteriole and returning vein, with a rich little capillary circulation about them. These extend almost completely through this thick mass of epithelium for its growth and support. (Fig. 1.)

If the superficial epithelial cells of the gingivae are scraped away with a sharp instrument, blood will ooze out long before any considerable portion of the epithelium has been removed. The bleeding is the result of cutting the ends of the connective-tissue prolongations into the

body of the epithelium, which carry the blood for the support and quick repair of abrasions and cuts received in chewing coarse foods.

These ends of connective tissue carry the blood supply to the thinnest part of the finest, apparently knife edge of the crest of the gingivae of the labial, buccal and lingual surfaces of the teeth. Then the epithelium is reflected over the thin margin and clothes also the portion of the soft tissue that is in contact with the enamel to the cemental line. This layer of epithelial cells is much thinner and especially are these cells much softer and less compact than those of the outer surface of the gingiva.

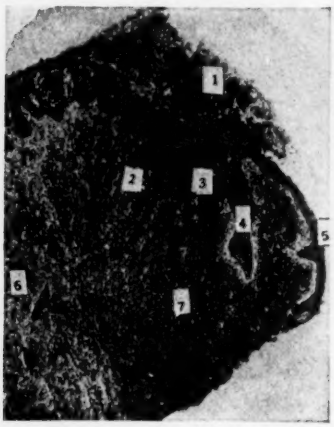

Fig. 3.—Section of gum tissue cut away to eliminate a pocket. A mass of débris is indicated by the figure 1. It will be noted that the epithelium has been almost completely destroyed in the region between 2 and 3, permitting infection to invade the deeper tissues, which are heavily infiltrated with round cells at 7. The epithelial lining of the crevice is shown at 5, and the line between the normal and infiltrated tissue is indicated by 6.

The reactions of the epithelium, in its efforts to afford protection to the connective tissue, are of great importance in the treatment of all diseases of the gingivae and peridental membrane. It is the one tissue that effects actual and permanent healing after detachment of the peridental membrane occurs.

In all cases of gingivitis, except the limited number in which the resistance has been lowered by some systemic condition, the recuperative ability of the tissues becomes apparent as soon as the cause of the irritation is removed. When these tissues have been compressed or otherwise damaged by trauma or infection, or both, without detachment of the peridental membrane at the cemental line, they will usually regain normal health and form very promptly after the source of the inflammation is removed. The gingivae themselves require no treatment. The

Fig. 4.—Section of gum tissue cut away to eliminate a pocket, showing a very imperfect epithelium along the right side which was adjacent to the tooth.

connective-tissue projections into the epithelium provide a blood supply for the quick repair of surface injuries or the rebuilding of the epithelium when considerable portions have been destroyed. A gingiva which is swollen and bleeds on slight irritation may fully recover within forty-eight hours.

The epithelium of the gingival crevice may project itself into the peridental membrane along the surface of the cemen-

tum in reaction to gingival inflammation. Its reacts in the same manner in cases of recession of the supporting structures in which, apparently, there is no inflammation. This appears to be Nature's way of preparing for a possible detachment of the peridental membrane from the cementum. However, in the movement, the epithelium will be projected to, but not beyond, the level at which principal fibers of the peridental membrane are attached to the cementum. (Fig. 2.)

When detachments of the peridental membrane occur at the cemental line, connective tissue is exposed, and the epithelium of the gingival crevice proliferates in order to grow over and protect this

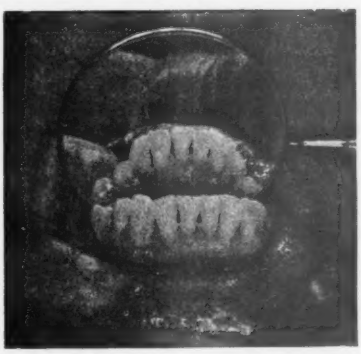

Fig. 5.—Reproduction of photograph of lower anterior teeth and gums ten months after a gum resection. (Lundquist.)

connective tissue. This effort may or may not be successful, depending in part upon the promptness with which the irritation is removed and in part upon the maintenance of cleanliness of the pocket for a sufficient time. In cases in which the detachment is slight, the down-growth of the epithelium will usually be sufficient to provide the same protection to the connective tissue as is normally afforded by the epithelium of the gingival crevice. Nature will completely repair the damage. However, there will probably be a depression in the line of attachment of the peridental membrane; if so, the corresponding region of the gingiva will recede a distance about equal to the detachment, thus forming a slight notch or depression in the crest of the gingiva.

When detachments occur to considerable depth before they receive attention, it may become impossible to control the infection for sufficient time to permit a good growth of epithelium to reach the bottom of the pocket. The quality of the epithelium may then vary greatly. There may be a single layer of cells on the surface, with or without projections into the connective tissue, or the cells may be disposed in almost any arrangement other than the compact layers which are necessary to afford reasonable protection to the underlying tissue. In such cases, there will be round-cell infiltration of the connective tissue as a reaction to bacterial invasion. There may be minute droplets of pus scattered among the epithelial cells, so that it seems questionable whether such a down-growth does harm or good. When this tissue is much inflamed, it will bleed when a peridental explorer is manipulated gently within the pocket.

There are several important tissue reactions which are related to the possibility of reattachment of the peridental membrane to the cementum. In cases of chronic suppurative pericementitis, in which a pocket is formed as a result of the detachment of the soft tissues from the root, the principal fibers of the peridental membrane, the ends of which are normally embedded in the cementum, disappear from the soft tissue that forms the pocket. They are not present in any histological section of pocket tissue. They either are destroyed by infection or are resorbed because they can no longer perform their function of supporting the tooth. Likewise, and for the same reasons, the alveolar bone is always resorbed in regions corresponding to the detachment of the peridental membrane from the cementum. The regeneration of alveolar

bone in these cases is dependent on the prior reattachment of the principal fibers of the peridental membrane to the cementum.

It will, therefore, be noted that the continued existence or the rebuilding of alveolar bone about the sides of the root is dependent upon the integrity of the principal fibers of the peridental membrane, and the continued existence of these fibers is based upon the maintenance of their attachment to the cementum. The cementum is thus the tissue of first importance in chronic pericementitis, and its condition is the key to the situation, so far as the regeneration of both the peridental membrane and bone is concerned.

The cementum is different from other tissues in the body. It is definitely a passive tissue; it does not originate any form of physiological activity. It is much like subperiosteal bone, but differs particularly in that bone has an abundant circulation of blood, and cementum has no circulation of blood. Bone is subject to resorption and rebuilding of its own tissues at any time, and changes in the structure of bone are constantly taking place. Cementum has no power of self-repair. Its vitality is entirely dependent on the peridental membrane, which builds it. When any portion of the cementum is cut off from its peridental attachment, that portion becomes a dead tissue. It has no power of initiating or carrying forward any process of repair, because, having no circulation of blood, it can participate in neither inflammation nor reparative reaction.

Cementum is also frequently subject to resorption, which begins on its surface as a result of the activities of cells of the peridental membrane. These resorptions are generally repaired by the cementoblasts of the peridental membrane, provided infection of the region has not intervened.

Two methods are conceivable by which pocket tissue might be reattached to the

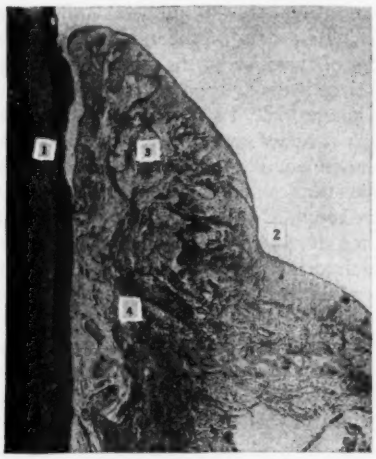

Fig. 6.—Newly formed gingiva three months after a gum resection by the author in 1918. The patient was a man about 50 years of age. There were pockets varying from 5 mm. to 8 mm. in depth about the lower incisors, and the teeth were so loose that extraction was advised. Upon the patient's insistence, a gum resection was performed, with the understanding that he would consent to the removal of the teeth three months later, if they did not then have considerably less motion. At the end of the agreed time, the teeth had not tightened sufficiently to justify their retention and an incision was made through the gum in such manner that a portion of the labial plate of the bone and soft tissues was removed with the four teeth in one block. A labio-lingual section was made through one of the incisors and in the illustration figure 1 indicates the position of the line of the incision in resecting the gum. This was at the deepest part of the pocket. The cementum was notched a little with a chisel at the time. The figure 2 indicates about the position in which the scalpel entered the gum, so that all of the tissue to the incisal of a line from 1 to 2 was developed from the tissues beneath, after the operation. After the epithelium of the gum had proliferated over the cut surface, it was apparently pushed incisally by the connective tissues below, until it assumed its present form. This new gingiva has a healthy epithelial covering, which is quite as thick in the gingival crevice as in a normal gingiva. Figure 6, 3 marks a deep projection of the epithelium, and 4, the crest of the bone of the process. The outer surface of the bone is undergoing slight resorption, evidently to reduce its thickness near the crest, thus conforming to the contour of the newly developed gingiva.

cementum: The first is the laying down of a new layer of cementum over that which is denuded. To accomplish this, the connective-tissue cells must lie in contact with the dead cementum and function actively. They cannot do this if the cementum has been bathed with pus for a considerable time, as the soft tissue cells would be destroyed. Also, there is no record of a new layer of cementum being laid down in an area exposed to the fluids of the mouth.

The second method is an effort to cut away the contaminated portion of the cementum. Here, again, to secure reattachment of the peridental membrane, it would be necessary that a new layer of cementum be deposited in the presence of the fluids of the mouth. This is theoretically possible, but has never been shown to have occurred. There is still another possibility of reattachment, such as occurs in the case of the implanted tooth, by the gradual resorption of the root and the building of bone into the resorbed excavations. In practically all cases of replanted teeth, this process of resorption continues until the tooth becomes so loose that it must be removed.

In view of the above statements, it seems logical to state that, notwithstanding the fact that reattachments of the peridental membrane to the cementum may possibly occur over very limited regions, for all practical purposes, the key to the treatment of suppurative pericementitis is in the statement that suppurative detachments of the peridental membrane are permanent detachments.

In cases of pressure pericementitis, the injury to the tissues is different from that in chronic suppurative pericementitis. In pressure pericementitis, the primary injury is to the bone. Abnormal occlusal stress causes the tooth to be tipped in its socket, with compression of the peridental membrane and pressure on the bone of the crest of the alveolar process on one side of the root and traction on the fibers of the peridental membrane on the opposite side. The result is the resorption of bone on the pressure side, usually without serious injury to the fibers of the peridental membrane. Gradually, more and more of the bone is resorbed on the pressure side, but without the formation of a pocket. The tooth becomes loose, whereas the peridental membrane maintains its attachment to the cementum. If the pressure is relieved, there appears to be no reason why the bone should not be rebuilt, because it can, by so doing, resume its normal function of supporting the tooth.[3]

TREATMENT

With an understanding of the tissue reactions, the planning of treatment may be definitely classified and simplified.

In all cases of gingivitis without detachment of the peridental membrane, the removal of the cause will result in prompt recovery. However, practically every case requires some particular form of subsequent treatment to prevent a recurrence. This is also, in the highest sense, preventive treatment of chronic suppurative pericementitis, which is likely to occur whenever cases of gingivitis are neglected. If the inflammation of the gingivae is due to any one of the local conditions mentioned, the real difficulty is not in the removal of the cause, but in the prevention of its recurrence. If it is due to lack of cleanliness or to deposits of calculus, the training of the patient to so brush the teeth and gums and otherwise care for the mouth that the gingivitis will not recur usually requires considerable careful direction, with insistence that the technic be exactly right, and a follow-up program to check on the patient's shortcomings. The dentist must himself take this task seriously if he is to secure the patient's hearty cooperation.

3. See illustrations 1, 2, 3 and 4 in G. R. Lundquist's paper in this issue of THE JOURNAL.

About 37 per cent[4] of all inflammations of the gingivae are due to imperfect dental operations, consisting of failures to make restorations in the best form and to reestablish proper contacts. The dentist who is unwilling to learn the lesson from his failures—to respect the gingivae—in his operative and crown and bridge procedures will always have on hand many cases of pyorrhea which will be unsuccessfully treated, because he fails to heed the first and most simple lesson in prevention.

It should be a part of every mouth examination to study each region of gingivitis, learn its cause and correct it by whatever procedure is appropriate. Margins of fillings and crowns must not irritate the gingivae, and good contacts must be maintained.

In the limited number of cases in which inflamed gingivae are not cured by these simple means—when swelling and inflammation continue after local irritation has been removed—one should make inquiry as to systemic conditions which might be reflected in the gingivae. Some of these cases fall within the province of the dentist; others should be referred to the patient's physician.

In cases in which there are detachments of moderate extent—that is, when there are pockets of slight depth—the treatment is exactly the same as has been mentioned for gingivitis, plus maintained cleanliness of the pocket to promote a good proliferation of epithelium to protect the exposed connective tissue. As the case heals, the gingiva will recede according to the depth of the detachment, and the case should require no special treatment thereafter.

When pockets are deeper, the difficulties of securing a satisfactory epithelial lining are increased, both in the removal of deposits and in the maintenance of cleanliness. Twice daily, irrigation with salt solution, using a large rubber bulb syringe, becomes an important part of the treatment. Medication is of no advantage, as it is more likely to inhibit than to promote epithelial proliferation. The quality of the epithelium can always be determined by manipulating a blunt-ended instrument within the pocket. If the lining is satisfactory, it will withstand irritation without bleeding, as will the surface of the gums when similarly irritated.

When a good epithelial lining may not be secured, the elimination of the pocket by gum resection should be considered. If the conditions are such that all of the pocket can be cut away, this operation will effectively remove the obstacles to complete healing and establish conditions that will enable the patient to keep the tissues clean. This operation not only eliminates the pocket as a harbor for micro-organisms, but also removes practically all of the infected tissue. The epithelium of the gum tissue will grow over the freshly cut surface almost immediately, and thus heal the wound. Within from ten days to two weeks, it will become so firm that it may be brushed vigorously with an ordinary toothbrush without discomfort and without the slightest hemorrhage. The tissues of the region are then as secure against reinfection as the other tissues of the mouth, provided the form is such as to present no unusual difficulty in maintaining cleanliness.

Within the next two or three months following such an operation, Nature again comes to the assistance of both dentist and patient by building a new gingiva. This appears to occur in response to the slight stimulation of food movements in mastication. The connective tissue seems to push the epithelium occlusally until the contour of the normal gingiva is reproduced. A comparison of this with a normal gingiva shows no consequential differences. The base of the new gingiva will be at the position of the incision made in resecting the gum, *i.e.*,

4. Black's Operative Dentistry, 1936, Vol. 4, p. 104.

at the level of the bottom of the former pocket. (Figs. 5 and 6.)

In cases of pressure pericementitis, it is evident that the resorption of the bone has resulted from the abnormal movement of the tooth. Obviously, the abnormal pressure on the tooth should be relieved by whatever means is most appropriate in the particular case. These cases are comparable to cases in which a tooth under orthodontic treatment has been moved so rapidly that there has been bone resorption without rebuilding, and the tooth is loose. Therefore, a stay appliance is oftentimes indicated. The essential damage in these cases is the resorption of bone without detachment of the peridental membrane. Relieving the occlusion and stabilizing the tooth should be conducive to the rebuilding of the resorbed alveolar bone.

When cases of pressure pericementitis become infected and more or less of the peridental attachment is destroyed, they should be classified as cases of chronic suppurative pericementitis, the treatment of which has been considered.

In this presentation, it has been suggested that full advantage should be taken of the recuperative powers of the peridental tissues, particularly in the proliferation of the epithelium, the regeneration of bone in cases of pressure pericementitis and the rebuilding of the gingivae in cases of gum resection. It is also suggested that, in cases in which the peridental membrane has been detached from the cementum by a chronic suppurative process, efforts to secure reattachments should be abandoned in the program of treatment.

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RADIUM AND X-RAYS IN THE TREATMENT OF MALIGNANT ORAL LESIONS

By Harold A. Solomon, D.D.S., and Melvin C. Reinhard, M.A., Buffalo, N. Y.

WHILE considerable material has appeared in the dental literature relative to the diagnosis and prevention of oral tumors, apparently little effort has been made to acquaint the dental profession with the use of radium and the x-rays in modern treatment of malignant oral lesions. In spite of the fact that cancer cannot be adequately treated in the ordinary dental office, a working knowledge of its treatment should be of more than academic interest to the profession.

It is universally admitted that the therapeutic agents of choice in the malignant tumor field at the present time are surgery and irradiation (radium and x-ray). The purpose of this paper is to outline briefly the rôle of irradiation.

In order to understand and appreciate the use of radium as a physical agent in the treatment of disease, it is necessary first to consider briefly the chemistry and physics of radium. As a chemical element, No. 88, radium is a member of a group of alkaline earth metals, others of which are calcium, strontium and barium. The chemistry of radium, therefore, follows in general the chemistry of other members of this group, the sulfates and hydroxides of which are insoluble, while the halides are water soluble. In general, it may be said that radium behaves chemically the same as any other element. On the other hand, radium differs physically from most

(From the State Institute for the Study of Malignant Diseases, Burton T. Simpson, M.D., director.)

of the other elements in that energy is spontaneously and continuously emitted, regardless of its chemical combination. This energy manifests itself in two ways, one as heat, which may be disregarded, and the other as radiation.

Radiation may be further subdivided into three separate and distinct types. The first of the types to be considered is the alpha radiation, which, in respect to its energy content, is the "Big Bertha." However, owing to the corpuscular nature of this radiation, it is easily absorbed; in fact, a piece of paper 0.003 inch thick will stop these rays. Consequently, because of the energy content and the ease of absorption, a severe caustic effect could be had were the skin exposed to these rays; but since we never handle radium which is not in a container of some type, usually glass or metal, no alpha radiation

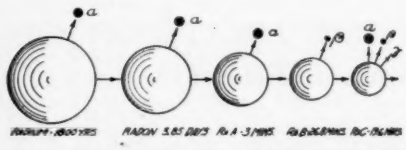

Fig. 1.—Three types of radiation produced by successive radioactive disintegrations starting with that of the radium atom.

escapes and, therefore, we need not consider it therapeutically.

The second type, the beta radiation, is also corpuscular. Its energy content is less than that of the alpha particles just described, but its penetration into material like mucous membrane or skin is greater. The intensity of a beam of beta radiation is reduced from 100 to 25 per cent in 2 mm. of soft tissue, and to less than 1 per cent in a centimeter. Its action on the mucous membrane or skin, like that of the alpha particle, is also caustic. Because of its greater penetration, it has a definite place in our armamentarium, being indicated therapeutically where definite destruction of tissue is desired to a depth not exceeding 2 to 3 mm. However, for most of the work for which radium is used, this caustic beta radiation is objectionable and must be removed. This is very easily done by surrounding the source of the radiation with suitable filters, usually of metallic nature. One millimeter of platinum or gold, or 2 mm. of brass will remove practically all of the beta rays.

The third type, the gamma ray, is pure radiation, in the sense that it is an electromagnetic vibration. This ray is one to be associated with radium therapy because of its selective action on cells, whether normal or malignant. Unlike the alpha and beta rays, which are easily absorbed, the gamma rays are very penetrating,

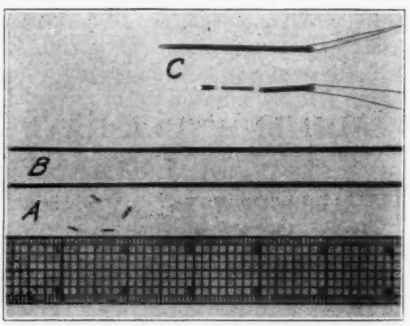

Fig. 2.—A, gold radon seeds. B, seed implanter. C, radium needle.

even 20 cm. of lead being insufficient to stop all of the rays. This property of penetration, as well as its action on cells, makes it one of the foremost agents in the treatment of pathologic conditions. We shall consider its application later.

The question has frequently been asked, "Are not these radiations of radium the same as the so-called 'emanation'?" That they are not can be simply shown by considering a mass of radium salt in which there are millions of radium atoms chemically combined with a radical. During any unit of time, a certain number of these atoms will explode. The num-

ber exploding depends on the number present; that is, the more atoms present in the mass, the greater the number that will explode. Let us select one of these atoms and observe its explosion and the successive explosions of its products, in order to obtain a clear picture of what "emanation" or radon is, as well as the relation it bears to radium and to radiation. A knowledge of these facts is essential to the clinical application of radium.

The radium atom (Fig. I) in exploding, gives rise to two distinct, dissimilar products and is itself destroyed. The process is much like that of a cell dividing to produce two daughter cells, except that, in the case of the radium atom, the products are dissimilar. One is a form of radiation, the alpha particle, and the other is an atom of radon, or radium emanation. This new atom is a gas at ordinary temperatures, and if the radium were in solution in water, this gaseous atom would be set free and bubble through the water and escape. Advantage is taken of this property of radon; for we actually remove the gas from a solution of radium chloride and compress it into small tubes of glass or metal which may be used clinically as a source of radiation.

In the case of solid crystalline radium, enclosed in a sealed container, the radon atoms are held mechanically from escaping and remain in contact with the unexploded radium. However, the subsequent course of events is the same whether the radon is separated from the radium or remains in contact with it. That is, the radon (Fig. I) in turn explodes in a similar way into two products. Again, one is an alpha particle, the other, a new atom. The same process continues through several explosions, each time the atom breaking up into a form of radiation and a new atom, the products being designated successively after radon, as radium A, B, C, etc. These atoms are solid and constitute what is known as active deposit. With the subsequent explosions and accumulation of the active deposit, the type of radiation changes, giving rise to both beta and gamma rays, in addition to the alpha. In other words, it is radium C in the active deposit that is the real source of the penetrating gamma radiation and not the radium itself.

Fig. 3.—Gold radon seeds planted in tumor mass in jaw.

Fig. 4.—Patient with radium needles inserted directly into tongue.

Where the radon is held together with the radium in a hermetically sealed container, an equilibrium is reached, where the rate of explosion of the radium atoms equals the rate of disintegration of the radon atoms. As a result, the intensity of the radiation is constant, decreasing only 4 per cent in one hundred years. With the radon in a separate container, however, no replacement occurs, so that the intensity of the radiation decreases at the approximate rate of 16 per cent a day. This decrease in intensity must be taken into consideration when radiation treatments with radon are extended over a period longer than one hour.

CLINICAL CONSIDERATIONS

After diagnosis is established by clinical and laboratory examination, the course of treatment is planned. At this point, it is necessary to consider several important factors, among which are: 1. Type of cells. 2. Size of the lesion. 3. Location. 4. Adjacent structures. 5. Physiology. (For example, if the salivary glands are to be subjected to the action of the rays, the patient is instructed to observe particularly good hygiene and to rinse the mouth frequently to compensate for the lack of saliva.) 6. Amount of soft tissue present. 7. Proximity of bone. 8. Presence or absence of metastatic involvement of the regional lymph nodes. 9. Removal of all forms of irritation. If an extraction is indicated, removal of teeth before radiation is favored because the rays inhibit healing of open alveoli, and osteomyelitis has been known to follow extraction performed while radiation reaction was taking place.

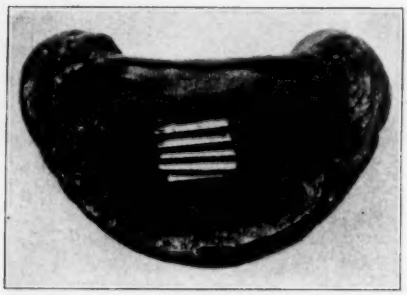

Fig. 5.—Mouth applicator; showing radium tubes or cells embedded in dental impression compound.

On the basis of the factors above noted, we select one or more of the following means of applying radium radiation: 1. Interstitial irradiation. 2. Surface irradiation. 3. Teleradium therapy.

INTERSTITIAL IRRADIATION

Interstitial irradiation is accomplished by the insertion of the radioactive material, either radium salt or radon, into or around the lesion to be treated. If radon is the source of radiation, it is usually contained in short pieces of gold tubing, approximately 3 to 5 mm. in length, and 1 mm. or less in diameter, with a wall thickness of about 0.3 mm. (Fig. 2, A.) Each unit of tubing, or "seed" as it is called, usually has a value in terms of radioactivity of from 1 to 3 millicuries. The millicurie is the unit of intensity from

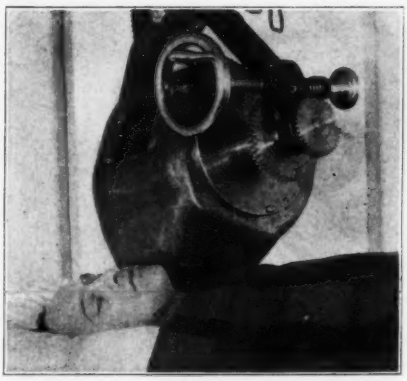

Fig. 6.—Four-gram pack applied to submaxillary and cervical regions for treatment of regional lymph system.

1 mg. of radium in equilibrium with its end products. During the life time of a 1-millicurie seed, which is approximately thirty days, there is delivered to the surrounding tissues a dose of 133 millicurie hours. From one to fifteen or more seeds may be used, according to the size of the lesion. Implantation of the seeds is made slightly inside the periphery of the lesion, and these seeds are not as a rule removed, but are allowed to remain. (Fig. 3.) Most of them become encapsulated with fibrous connective tissue, while some of them later make their way to the surface and are extruded.

Fig. 7.—Treatment of palatal region by use of 200,000 volt x-rays.

These "seeds," or implants, are used for lesions which occur in areas where sufficient soft tissue to hold the implants is encountered, such as the cheek and tongue. It is obvious that they cannot be utilized to advantage on the gums or palate where the soft tissue is in close proximity to bone and is relatively lacking in bulk.

The area to be implanted is locally anesthetized and the seed deposited by means of a hollow needle, inside which is a stylet.

Another form of interstitial irradiation used is from the radium salt mounted in hollow gold or platinum needles ranging from 1 to 5 cm. in length and having a wall thickness sufficient to remove practically all the beta radiation. At one end of the needle is a removable threaded screw tip and at the other end is an eyelet. The platinum-encased radium cell is placed in the needle after the removal of the screw tip. (Fig. 2, C.) The tip is then replaced and a steel wire is run through the eyelet to facilitate handling of the needles. A small loop is made in the wire, close to the eyelet, and when the needle has been inserted in the tissue, a linen suture is run through the loop and then through the tissue in order to prevent the needle from becoming dislodged on being subjected to motion of the oral structures.

The amount of radium in each needle may vary from 1 to 5 or even 10 mg. per centimeter length. This type of applicator is frequently used in tongue lesions (Fig. 4), as well as in large papillary lip lesions. The dosage is usually 100 to 200 mg. hours per centimeter of active radiating length of the needle. This form of treatment is extended over several days, the needles being removed to terminate the treatment.

SURFACE IRRADIATION

In surface irradiation, radium in the form of small tubes is placed directly against the surface of the lesion. Enough tubes are used and arranged so as to produce a uniform distribution of radiation in the tumor. Since the conformation of the parts of the mouth varies, it is necessary to make use of a material that can be readily molded to the various contours of the mouth. After discarding vulcanite and soft metal appliances as too costly and inefficient, we have, with marked success made use of impression compound for this purpose. Surface applicators made

from this material are readily constructed and prove very comfortable to the patient. (Fig. 5.)

A full or partial denture impression tray of adequate size and proper shape is selected and an impression is made of the diseased area, including the adjacent structures in order to immobilize the mold. The shape of the lesion is outlined on the impression material and then the radium tubes are embedded within the outlined area. This type of applicator is used where soft tissue is limited, as in the gum and palatal regions.

The duration of the treatment depends largely on the location of the lesion as well as on the amount and distribution of the radium which is available. Usually from 50 to 100 mg. of radium are applied from one to three hours a day for several days. The filtration, heavier as a rule for this type of irradiation than for interstitial, consists of 0.8 mm. of platinum or its equivalent. The dosage to be delivered to the tumor is governed by the area over which the radium is distributed and by the depth of the lesion.

TELERADIUM THERAPY

As the name implies, teleradium therapy refers to treatments where the radium is suspended at a distance, usually 6, 10 or 15 cm. from the skin. The object of using these distances is to produce greater relative intensities at points below the skin. For example, at 6 cm., a skin erythema dose may be given in 12,000 mg. hours, which means 1,000 mg. for twelve hours, with a resulting depth intensity of 33 per cent of the surface or skin dose at a point 5 cm. below the surface. Increasing the distance to 10 cm., the skin erythema dose becomes 20,000 mg. hours, with an increase of the intensity at the point 5 cm. below the surface to 44 per cent. Since small quantities of radium at the distances indicated would deliver too low an intensity at the skin surface, it is essential to use fairly large amounts of radium (1 to 5 gm.). In order to protect the attendants and the patients, as well as to confine and limit the beam, this large quantity of radium is surrounded with several inches of lead on all sides except that through which the radiation is desired. Emanation in glass or metal capsules may also be used in this type of pack. The packs used at the New York State Institute for the Study of Malignant Diseases contain from 2.0 to 4.5 gm. of radium. (Fig. 6.)

Teleradium therapy is used in irradiating not only the lesion itself, but also the lymph bearing areas and the regional lymph nodes adjacent to the lesion as well. High-power x-rays are also used as an agent for this purpose.

X-RAY THERAPY

Since the use of large quantities of radium is limited to a few institutions, it is the usual procedure to use 200 kilovolt x-rays for this type of therapeutic attack. X-rays may be used to decided advantage because the greater intensity of radiation from an x-ray tube permits shorter treatment time; and, what is of even more importance, it allows a greater distance between the source of radiation and the body surface. This last mentioned factor, as with radium, results in a marked increase in the amount of radiation reaching a tumor located at some depth below the body surface. (Fig. 7.)

Fortunately, with the establishment of an international unit of x-ray quantity and with satisfactory means of measuring and expressing x-ray quality, we can now describe x-ray dosage in the same fundamental factors that medicinal dosage is described.

A beam of radiation is defined qualitatively in terms of penetration. It is labeled according to one of two methods accepted to date; that is, as having an effective wave-length in Angström units, or as having a half value absorption layer of a certain thickness of some metal, usually copper or aluminum. Both of these terms are indications of, and are

based on, the power of the beam to penetrate certain materials. In other words, if we know the effective wave-length or the half value layer of a beam of x-rays, it is unnecessary to know whether that beam is generated by 200 kilovolts (200,000 volts) with a 0.5 mm. copper filter or by 160 kilovolts (160,000 volts) with a 1 mm. copper filter. This qualitative factor is just as essential as the naming of a drug in medicinal dosage.

Likewise, a quantitative statement of dosage is just as important as the accurate statement of the quality of the beam. Recently, there has been accepted universally a unit of x-ray quantity, the "roentgen" or international "r" unit, by means of which dosage may be expressed in total number of "r" units applied. Detailed discussion of this unit is unnecessary for the purpose of this paper, but suffice it to mention that as a practitioner prescribes a definite amount of a drug in grams or grains, just so the roentgenologist states the exact number of roentgens of a definite beam of x-rays which should be applied in order to obtain the desired results.

Since a biologic system shows recovery from irradiation, it is possible to administer a greater amount of irradiation if the time over which the rays are applied is extended over several days instead of the entire dose being given in one period. Present-day methods indicate that prolongation of exposure has a better effect on the tumor and the patient, so that treatments are extended over as long a period as twenty or more days, and the dose is increased accordingly. Thus, the necessity of stating the time factor is indicated.

Up to this time, we have discussed surface dosage of x-rays, but when the lesion to be irradiated lies below the surface, as is usually the case in irradiating lymph-bearing areas, as well as lip and other lesions, there are two other factors which must be considered. One is the distance from the source of the radiation to the body surface, known as the "target skin distance." The other is the size of the area to be irradiated. Both of these factors must be known in addition to the other three factors, in order to administer deep x-ray therapy intelligently and successfully. Thus, a complete x-ray prescription should include the following: 1. The quality of the beam expressed in half value layer or effective wave-length. 2. The quantity of the radiation, expressed in roentgens. 3. The time over which that quantity is to be applied. 4. The target skin distance. 5. The field size.

SUMMARY

1. To appreciate the use of radiation, some knowledge of the chemistry and physics of the agent used is necessary. Radium has three distinct types of rays, the alpha, the beta and the gamma. The first has no application in therapy; the second is used in about 5 per cent of all kinds of general treatment; whereas the third, or gamma, type of radiation is used in the majority of cases. Filters are used to remove the first and second types when indicated.

2. Anatomic, histologic and physiologic factors must be considered in planning treatment.

3. Three methods of procedure are used in radiation therapy: interstitial, surface and teleradiation.

4. The x-rays are more universally used owing to limitation of sufficient quantities of radium to a few institutions. They lend themselves admirably to treatment of many oral lesions and are of particular value in treatment of the regional lymph system.

5. In addition to the total amount of radiation applied (dosage), time and intensity are important factors in all forms of radiation therapy.

THE DENTAL ROENTGENOGRAM: OBSERVATIONS AND COMMENTS

By Louie T. Austin, D.D.S., Rochester, Minn.

THE use of the roentgen rays in dentistry today is common. It is unfortunate that their use is expensive, as they could be employed advantageously a great deal more than they are, and there is no department of dentistry that would not benefit from their use. The cost has to be borne by the patient, and there is no satisfactory way of distributing it.

Dentists have been unfair in allowing the patient to believe that a so-called set of films is worth anything to him, since few laymen can make anything of such roentgenograms. After looking at a dental roentgenogram, patients usually say that they see what looks like a "bunch of toes." The actual value of the dental roentgenogram is to the dentist.

The roentgen rays without doubt have been the greatest single factor in the recent progress made in dentistry. Their early use showed the deplorable condition of the mouths of many patients, which unfortunately was often the result of faulty and poorly devised dental procedures that were considered good practice at the time. They brought about the revision of many practices and have promoted the development of exacting technics, many of which today are checked progressively by means of the roentgen rays to show results and evidence of failure that cannot be revealed by other means.

Today, a dentist seldom shows a roentgenogram of a newly constructed prosthesis which has a high polish unless the margins are perfect.

When a new patient is first examined, it is worth while to make roentgenograms of all his teeth and their supporting structures, as a matter of record. Subsequent developments frequently will make these roentgenograms invaluable.

Roentgenograms of single regions will be found inadequate for purposes of comparison, and those made periodically of teeth which are known to have been pulpless many years and which have root canals that have been filled will show very little change. It is the roentgenogram of the rest of the teeth and the roentgenogram of edentulous regions that are of greatest interest and value.

Evidence of new growths and bony changes which are indicative of systemic disease will be seen occasionally in dental roentgenograms. Dentists, since they see their patients more frequently than do physicians, are likely to obtain early information on diseases that may be important in its treatment.

INTERPRETATION OF THE DENTAL ROENTGENOGRAM

In the interpretation of the dental roentgenogram, the greatest difficulty is encountered with roentgenograms of the upper part of the mouth, because of the variety of structures encountered. In the region of the molar and bicuspid teeth,

(From the Section on Dental Surgery, The Mayo Clinic.)

(Read before the Section on Oral Surgery, Radiology and Anesthesia at the Midwinter Clinic of the Chicago Dental Society, February 17, 1937.)

along the upper border of the roentgenogram, one may observe the cavity of the maxillary sinus. This cavity is bilateral and ordinarily will assume the same outline on each side of the mouth. It has a very definite limiting border which usually extends anteriorly to the region of the root of the first bicuspid tooth. Occasionally, however, it is considerably larger than normal and will extend anteriorly as far as the root of the lateral incisor. On rare occasions, one may find a complete absence of the cavity on both sides.

When dealing with a root cyst in this region, one will immediately notice the dissimilarity of the outlines of the two sinuses, and it is sometimes difficult to determine what portion of the radiolucent region is root cyst and what portion is normal maxillary sinus. If one bears in mind that cystic regions are the result of destruction of bone by pressure which is equal in all directions, one will usually be able to follow the outlines of the cystic cavity, even though it has a tendency to bulge or push back the floor of the sinus. When one encounters dissimilarity in the maxillary sinus, one should suspect the presence of a dental cyst. The patient will usually give a history of dental trouble in this region, and a vitality test of the molar and bicuspid teeth will reveal the fact that a tooth in this region is non-vital.

At times, one will notice the marked difference in density of the two maxillary sinuses. This is evidence of an infected maxillary sinus, and is spoken of generally as a "cloudy" antrum. The cloudy appearance of the affected side is the result of thickening of the mucous membrane which lines the cavity. The thickening is the result of inflammation of the mucous membrane. One should be cautious in making the statement that the patient has an infected antrum, in the absence of acute pain and the discharge of pus through the nostril on the same side. The old saying "once an antrum, always an antrum" is very true. Once the membrane has become thickened, it seems to remain so, and will always cast a more dense shadow than is normal. In observing a roentgenogram which reveals this difference in density, one should, in the absence of acute pain and drainage, limit himself to stating that the patient has had, at some time, an acute inflammation or infection of the maxillary sinus.

Surgical procedures on the maxillary sinus often will produce radiolucency in this field, for which it is difficult to account. If an unexplainable radiolucency does show up in the field, by raising the lip one may observe the scarring which resulted from operation on the maxillary sinus. Occasionally, operation on the maxillary sinus may injure the nerve and blood supply of the cuspid and incisor teeth on that side. The numbness of these teeth which some patients experience after operations of this sort is transitory unless the roots of the teeth themselves have been severed.

The intimate relationship which exists between the molar and bicuspid teeth and the maxillary sinus occasionally results in a perforation of the sinus at the time of extraction of these teeth. This will be shown in the roentgenograms of edentulous mouths by a broken continuity of the floor of the sinus. If an exposure of the sinus occurs in extraction of the upper molar and bicuspid teeth, the opening usually will be small. However, large portions of the floor of the sinus may be broken away and the sinus may be laid wide open. Simple exposure or perforation of the maxillary sinus occurs much more frequently than is generally supposed. If the socket of the tooth is allowed to become filled with a normal blood clot and if it is not further disturbed, by far the greatest percentage of such sinuses will undergo repair without further damage. It must be said, however, that when dentists do recognize the fact that the antrum has been perforated, there occasionally is a tendency to wash it out and to make use of wicks and drains to keep the cavity open. This tends to pro-

duce a chronic fistulous opening into the cavity, as the margins of the opening become covered with epithelium, and a permanent communication will be produced. If a small opening is observed, the patient should be advised to refrain from blowing his nose or rinsing his mouth too vigorously, in order that the clot which normally will form in the socket may not be disturbed.

If a considerable portion of the floor of the sinus has been dislodged or if a permanent opening has been established, an attempt should be made to close the opening by means of a small pedicle flap of soft tissue taken from the roof of the mouth and swung over the opening to close it. The pedicle of the flap should be directed toward the posterior palatine foramen, from which it gets its blood supply. It will be noted that the openings heal over with soft tissue rather nicely. However, the bony floor of the antrum never seems to be replaced.

At times, during extraction, the ends of the roots of fractured teeth are forced into the maxillary sinus and an entire tooth occasionally is forced into the sinus because the layer of bone which separates the teeth from the sinus is very thin. In either event, it is well to enlarge the opening sufficiently to remove the fragments or the tooth, as infection is likely to result, and one should advise the patient of the situation.

Along the upper border of the roentgenograms of the upper molar and bicuspid teeth, one occasionally will encounter evidence of radiopacity for which it is difficult to account. If the mouths of the patients are examined, an overgrowth of the cortical bone directly in the midline, which is termed *torus palatinus,* will be observed. The same thing is frequently found on the lingual surfaces in the region of the lower cuspid and occasionally at the angle of the mandible. This hypertrophy of the cortical layer of bone in these regions is of little significance, except in those instances in which it may interfere with the proper placement of dentures. The condition can be readily corrected by turning back a flap of soft tissue and removing the hypertrophied bone with a mallet and chisel.

In the roentgenograms of the lower part of the mouth, one may encounter radiopaque bodies that may be mistaken for evidence of the remaining substance of teeth or even entire teeth. These bodies have about the same density as teeth. Occasionally, calculi will be present in the sublingual or submaxillary glands. Because of the position of the roentgenograms, these shadows are superimposed over the dental tissues. If a bite roentgenogram is made by placing a film flat on the occlusal or incisal surfaces of these teeth, and if the roentgen rays are directed upward through the jaw at right angles to the film, these calculi can be demonstrated, and because of the change in angulation at which the roentgenogram is made, the shadows of the calculi will be thrown entirely away from the mandible and their presence indicated. Occasionally, these small calcareous concretions will be observed in the upper part of the mouth in the region of the parotid gland or in Stensen's duct.

DENTAL CONDITIONS EVIDENT IN THE ROENTGENOGRAM

Evidence of the formation of calculi in the pulps of teeth will be observed very frequently in roentgenograms of adults. Kronfeld[1] says, in his "Histopathology of the Teeth and Their Surrounding Structures," that they can be demonstrated microscopically in more than 80 per cent of adult teeth. Many teeth have been sacrificed because of these formations, in the hope of benefiting the patient. In our experience at the clinic, removal of teeth simply because pulp stones have been noted in the pulp chambers or canals has seldom been of benefit.

It was thought at one time that formation of calculi in teeth might be related to the formation of calculi in other parts

of the body, such as the kidney and the gallbladder. It was found, however, that the incidence of pulp stones in the teeth of patients who had calculi in other organs was no greater than it was in the teeth of patients who did not have calculi in other organs. It has been taught that pulp stones may cause a spontaneous devitalization of teeth, or may produce neuralgia which cannot be accounted for in any other way. It is my opinion that one should be extremely cautious in promising a patient much relief from removal of the affected teeth, simply because of these deposits in the pulp.

It will be noted that in the dental roentgenograms of some patients, there has been found evidence of a marked recession of the pulp chambers of the teeth; while in those of other patients of the same age, recession has not taken place with the same rapidity. Those teeth that show greater recession of the pulp chambers will be observed to be subject to greater irritation and will give evidence of considerable wear. The use of the dental roentgenogram will be found of value in determining the extent of recession of the pulp chambers in those instances in which restorations are to be made that require extensive retention, or in cases in which porcelain jackets are to be used.

Recently, I observed dental roentgenograms of a young patient which showed that orthodontic procedures had been undertaken. The retaining appliances were still in position. I was struck by the fact that the upper central and lateral incisors particularly showed considerable loss of the ends of their roots. I recalled seeing the young woman a year or two previously. In reexamination of the roentgenograms which had been made previously, I found that while the teeth showed irregularity as regards position, they were then of normal length. Undoubtedly, the too rapid movement of these teeth had resulted in resorption of the ends of the roots instead of a breaking down of surrounding bony tissue, which naturally is much less dense. Considerable damage can be caused if care is not exercised as to the rapidity with which teeth are moved in the correction of malposition.

There is another loss of tooth substance which is spoken of as idiopathic resorption. It will be noted in that portion of the root which is completely embedded in bony tissue. While this type of resorption cannot be attributed to any particular condition, this loss of tooth substance is probably the result of an inflammatory process. Such teeth will be found normal in every other respect; *i.e.*, as regards vitality, color, comfort, etc. Resorption of the root ends of the teeth is of course common in the presence of some long-standing pathologic process or as the result of certain types of therapy of root canals.

In contrast to this loss of tooth substance, one will frequently encounter an overgrowth of tooth substance, which generally is spoken of as hypercementosis. In this condition, the cementum of the tooth may become rather bulky. This change is, I feel, of little significance, except perhaps with regard to added difficulty at the time of extraction. It may involve any of the teeth. It occurs most frequently in the lower bicuspid teeth, which may account for some of the difficulty one experiences in removal of these teeth. The condition is easily distinguished from a bony change, since the overgrowth is encapsulated by the peridental membrane.

Hypoplasia of enamel also will be noted in typical Hutchinson's teeth; that is, the teeth of patients who have hereditary syphilis. Some writers speak of a notching of the incisal margin. This particular fault is not necessarily significant. The convergence of the lateral walls of the incisor teeth as they approach the incisal edge with very definite thickening labiolingually is the more characteristic marking of the hutchinsonian tooth. With this particular type of tooth, the first

molar, if present, will have lost its normal cusps, and will be roughened and the surface will resemble that of a mulberry. The name "mulberry first molar" has been given the tooth. This tooth is not resistant to caries. With Hutchinson's teeth, if the patient has reached adult life, all the first molar teeth frequently are missing. This characteristic marking of teeth is always looked for by the syphilographer in establishing a diagnosis of hereditary syphilis.

The portion of a tooth which shows hypoplasia of enamel as a result of some early metabolic disturbance is rather resistant to caries. Hypoplasia of this sort is ordinarily limited to the incisal third of the anterior teeth. The condition will produce radiolucency in the affected portion of the tooth and there will be a very definite line of demarcation.

ROENTGENOGRAM AS AN ADJUNCT IN OTHER DENTAL CONDITIONS

Congenital absence of teeth is rather common. Congenital absence of the third molars is common and absence of upper lateral incisors occurs rather frequently. Occasionally, a small lateral incisor may be present as a rudimentary tooth. In rather rare instances, absence of several teeth will be noted in the same mouth. This lack of tooth substance has been attributed by some authorities to hereditary syphilis, but this seems rather unlikely since it occurs frequently where no other evidence of this disease can be found.

Supernumerary teeth are encountered in one of every hundred patients. Any of the teeth may be supernumerary and the situation is of little consequence, except that, in the period of formation, such teeth may interfere with normal development and eruption of the neighboring teeth.

In two families, I noted that supernumerary central incisors were present in the mouths of the son, father and grandfather. Since there is an intimate relationship between supernumerary teeth and their neighbors, removal of the former is likely to injure the neighboring teeth. If the dental surgeon does not wish to remove them, they at least should be checked from time to time by means of the dental roentgenogram to determine whether they are interfering with the neighboring teeth, becoming cystic or creating a disturbance in other ways.

One also may occasionally encounter odontomes, particularly of the compound composite or compound complex varieties. These growths, which are made up of tooth substance, vary from the single denticles, which occur most often in the region of the cuspid teeth, to the large masses of complex tooth substance, found most frequently in the posterior regions of the mouth. Odontomes may interfere with the normal position of neighboring teeth and, with their eruption and development, the growths may become cystic. If the dental surgeon does not care to remove them when they are first discovered, dental roentgenograms should be made periodically in order to avoid trouble at a later date.

Transposition of teeth will occasionally be noted. A cuspid may erupt directly in the midline or a bicuspid may erupt in the molar region. The situation is of little significance; ordinarily, there is some associated malocclusion.

Deciduous teeth are occasionally found in the mouths of persons who are well past middle age. These deciduous teeth have resisted decay, and while their root attachment is slight as compared to the attachment of the permanent neighboring teeth, they seem to stand the stress of mastication fairly well and, in many instances, are far superior to any artificial substitute that might be provided. The quite common practice of extracting these teeth on sight is a rather radical procedure. There is no doubt that they do at times become carious and are associated with pathologic changes in the dental structures. In this event, their ex-

traction is indicated. Ordinarily, when one encounters a retained deciduous molar in adult life, its permanent successor will be missing. In the case of a lower deciduous cuspid, the permanent successor usually will be found unerupted somewhere below it.

In cases in which extraction has never been undertaken and all of the permanent teeth are present, dental roentgenograms will frequently present evidence of the ends of the roots of other teeth in the alveolar process. These are ends of the roots of deciduous teeth which were left behind after their replacement by the permanent teeth. This condition follows the eruption of a permanent tooth into a widely bifurcated root of a deciduous tooth. The crown of the permanent tooth erupts well up into the bifurcation before resorption of the roots of the deciduous tooth begins. It will be noted that, in some of these cases, resorption takes place at about the middle third of the end of the deciduous root, almost at right angles to its long axis. As the permanent tooth erupts, the crown of the deciduous tooth is dislodged from the ridge, leaving the end of the deciduous root behind. This soon becomes covered by the alveolar process.

It is doubtful whether the ends of these deciduous roots are infected; however, if these ends are encountered in edentulous regions, one cannot be positive that they are deciduous roots. If removal of the foci of dental infection is indicated, one is justified in advising the removal of such roots.

It has been shown repeatedly in studies of dental roentgenograms that one of every three edentulous patients has one or more ends of roots left in the alveolar process, and that one of every five patients who have teeth present will have ends of the roots of teeth in their mouths after incomplete extraction. In practically all of these cases, the presence of such roots is unknown to the patient.

Anomalous formations of teeth, such as three-rooted lower molars, bifurcation of the apical end of single-rooted teeth and fusion, are rather common, but are of no particular significance.

Two types of cystic conditions are frequently associated with the dental system, occurring in one of every hundred patients. These are the root cysts, which are associated with the ends of the roots of an infected tooth, and the dentigerous cysts, in which the coronal portion of the unerupted tooth will be found lying in the cystic cavity, the capsule attached to the neck of the tooth and the root buried in normal bony tissue. The dentigerous cyst has a tendency to grow and, until the cyst is perforated, the contents will be sterile. Because of the tendency of such cysts to become larger and because of their effect on the neighboring teeth, extraction of the involved tooth is always indicated.

The roentgenogram of the root cyst will reveal a definite limiting border, which can be readily followed throughout its entire circumference, and the surrounding bony tissue will have an increased density. Root cysts usually are filled with fluid, which varies from a thin, straw-colored substance to a very thick gelatinous material of the consistency of butter. The contents sometimes are almost black and are always infected. The cysts occasionally may assume rather large proportions, and may involve neighboring teeth and even become large enough to cause spontaneous fracture. On removal of the tooth or teeth involved, it is important that the limiting membrane of the cyst be carefully removed, to prevent recurrence. The membrane ordinarily is very readily removed, and, in the smaller cysts, if the cavity is allowed to become filled with a normal blood clot, repair will take place without further attention.

Cysts of this type may remain in the mouth for a long time and may produce little or no discomfort. Most often, there is no communication with the oral cav-

ity, although occasionally there may be a draining fistula.

A rather peculiar density of bone will at times be noted adjacent to the root ends of teeth in the mandible. In this case, there has been either a resorption of the root ends of the tooth or an incomplete calcification. There is also a type of scarring which surrounds a region of rarefaction and which occurs at the end of the root of a non-vital tooth. Simpson has spoken of this as very definite evidence of dental infection. It is this type of scarring or inflammation of bone which he called condensing osteitis. Occasionally, following removal of a tooth, the socket will be repaired with very dense bone, which will be almost as radiopaque as tooth substance itself. While this bony tissue is not normal, it should not, I believe, be disturbed, except probably in very rare cases, since cultures will usually be found negative.

Supernumerary teeth frequently become cystic. In a study of a series of these teeth, 5 per cent were found to be definitely cystic and some of these cysts had attained considerable size.

Regions of residual infection will occasionally be seen in edentulous spaces. Their persistence is probably attributable to granulation tissue developing at the root ends of infected teeth which have been left behind at the time of extraction. Naturally, by far the greater majority of the infected cavities take care of themselves after elimination of the offending tooth, since the incidence of rarefaction at the ends of the roots is greater than it is in regions of residual infection. Occasionally, one encounters infected cavities which justify the contention that the membranous material of these cavities should be carefully and completely removed. Some of them have been found in position many years after extraction. Cultures of the majority of them will be positive. Many regions of lessened density have been mistaken for areas of residual infection, which are later found to be the result of loss of a portion of bony tissue.

For a long period of time, rarefaction has been observed at the ends of the roots of teeth which otherwise were normal. This it has been difficult to account for. Stafne[3] has reported a rather large series of cases in which this condition was present and he has termed the condition cementoma. It apparently is an overgrowth of the fibrous tissue which occurs at the root end of the peridental membrane. This fibrous tissue becomes filled with dense bonelike material with cementum scattered definitely throughout. In the later stages, the involved regions appear to become almost solid, with a halo of more radiolucent tissue surrounding them and separating them from normal bone. Since the involved teeth are perfectly normal in every other respect, this condition is, I believe, of little significance.

Another cyst which occurs in the upper part of the mouth in the region of the anterior palatine fossa or foramen, and which is not associated with the dental system, was first mentioned by Meyer,[2] of the University of California, who suggests that it originates from epithelial remnants that persisted in the nasopalatine closure. At the clinic, we have observed this type of cyst in no less than one of every hundred adult patients. It will very frequently be observed in cases in which normal incisor teeth are in position and, as a result of the angulation at which the roentgenogram is made, it may be superimposed over the ends of the roots of the upper anterior teeth. The contents of this cyst are probably sterile until the cyst becomes perforated. Usually, the patient is unaware of the presence of cysts until they attain considerable size.

Impacted teeth are very commonly observed in the dental roentgenograms of adult persons. The average age of the patients seen in the Section on Dental Surgery at The Mayo Clinic is slightly

more than forty years, and impacted teeth are found in the mouths of about 10 per cent of them. The impaction may be multiple and any of the teeth may be impacted or unerupted. The most common offender is, of course, the third molar.

One author has said that any human tooth which cannot be brought into normal position and restored to its normal purpose of function is better out than in. At the clinic, our attitude toward this type of tooth is more conservative. We believe that unerupted teeth that are lying within the body of the bony tissue and apart from the neighboring teeth, and that do not cause any local symptoms, can be retained with little danger to the host. We do feel, however, that they should be examined roentgenologically from time to time, as they occasionally may become cystic. An unerupted or impacted tooth may affect the normal eruption and development of the neighboring teeth; and if considerable pressure is exerted, it may result in reflex pain or neuralgia. It also has been contended that, as a result of pressure, a region of lowered resistance may develop and that this may afford a suitable place for bacteria to become localized, and therefore may act as a secondary focus of infection.

Anterior teeth are subject to a great many accidents. It will be noted that after injury to an anterior tooth, if the tooth has lost its vitality, no further change will take place in the size of the pulp chamber. When that chamber is compared with the pulp chamber of the corresponding vital tooth, the former will appear larger, the size depending on the lapse of time since the accident occurred. There will be a rarefaction at the end of the root of the tooth, and a change in color will be noted. In some instances, just the opposite condition follows an injury. Complete obliteration of the pulp chamber and a loss of normal translucency of the tooth occur. In these instances, there is never any rarefaction at the root end of the tooth. I am not prepared to say just what causes this difference.

The roots of anterior teeth are frequently fractured. In the routine roentgenographic examination of the mouths of patients, one is surprised at the number of these roots which are retained in the mouth. Many of the patients are unaware of the fact that their mouths contain fractured roots, and they are unable to recall an injury. In studying a series of these fractured anterior roots, I observed that if the fracture occurred in the middle third of the tooth and at right angles to the long axis of the tooth, with no displacement of the root end, in a large percentage of cases these teeth retained their vitality and normal color, and did not cause any discomfort. If the line of fracture approached too near the crest of the alveolar ridge, or if it occurred in the apical third of the tooth root with some displacement of the fractured portion, the tooth usually was nonvital. While tooth substance is considered inactive, once calcification is completed there is evidence of attempted repair on the part of the cementum, in some instances. It is, therefore, of importance, in the case of accidents, to consider the position of the fracture, as it is possible that some of the teeth, even though fractured, can be retained as useful. After accidents, teeth may be found slightly displaced, and if they are pushed back into their normal position, it will be found in many instances that satisfactory repair will take place and that the teeth will retain their vitality.

When fracture of the jaw occurs, fragments of broken teeth and teeth observed to be lying in the line of fracture should be removed at once in order to avoid delay in repair and to prevent the occurrence of complications. After dentures have been worn by patients for a considerable time, pain frequently develops that cannot be accounted for by clinical examination. A dental roentgenogram will

be of assistance in pointing out conditions such as the presence of retained ends of roots, cysts and unerupted teeth, which may be a factor in the production of the pain. Difficulty may follow rapid resorption of the alveolar ridge, particularly in the lower anterior part of the mouth, as the ridge at this point becomes extremely thin and sharp, and pressure on the denture in this region is very uncomfortable. In the dental roentgenogram, it will be observed that the remaining alveolar process appears very thin. In correcting the condition, it will be necessary to expose the alveolar ridge and round it off by means of files or other suitable instruments. Occasionally, the extreme loss of alveolar process in the region of the mental foramen will cause the structures which pass through the foramen to be pinched by pressure of the lower denture, just as occurs in the region of the anterior palatine fossa. Relief of the denture at this point usually will make the patient comfortable.

Metallic foreign bodies, if demonstrable in the dental roentgenogram, will be encapsulated by fibrous tissue. They are of little consequence.

The use of the dental roentgenogram will be found of great value in the early recognition and treatment of pyorrhea. Much of the success of treatment of pyorrhea depends on its early recognition. Frequently, in the clinical examination of the mouth, owing to the presence of the associated soft tissues, pyorrheal pockets or loss of alveolar process may be overlooked, whereas such changes are readily noted by means of the dental roentgenogram. From the roentgenologic evidence, pyorrhea seems naturally to fall into two types. In one type, there is a rather uniform loss of the crest of the ridge, together with an associated caries; in the other type, only certain portions of the alveolar process are involved and there is almost total absence of dental caries. The former type is the one which responds most rapidly to treatment. It is my opinion that when two-thirds of the bony supporting structure of single-rooted teeth has been lost, or when the bifurcation or trifurcation of multiple-rooted teeth has become involved, these teeth are beyond treatment by the average practitioner and should be removed. More teeth are lost as a result of pyorrhea than from any other single condition.

In studying a large series of patients, taken routinely as they came to the clinic, it was found that three-fourths had pyorrhea of an advanced degree.

It is known that bacteria obtained from the depths of pyorrheal pockets have the same selective action and affinity for certain tissues in the body as do bacteria obtained from the ends of the roots of infected teeth. Simply pointing out the presence of infection of the roots in the mouth and neglecting to call attention to the condition of the soft tissues and bony supporting structures is, I believe, evidence of negligence on the part of the dentist.

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THE ACTION OF MOUTH ORGANISMS ON CERTAIN CARBOHYDRATES

By HAROLD L. HANSEN, Ph.D.; LEONARD S. FOSDICK, Ph.D., and CHARLOTTE F. EPPLE, A.B., Chicago, Ill.

THE result of the action of ptyalin on cooked starch is a rather complex mixture of soluble starch, dextrins and maltose, the last substance being the end-product of the enzymatic process. Since such a mixture of substances constitutes an essential ingredient of the substrate with which mouth organisms are in contact, it would seem profitable to make a study of the action of mouth organisms on each of these carbohydrates.

So far, no one has recorded any extensive investigation of the action of the mouth organisms on starch or dextrins. While the rapid production of reducing sugars by the action of ptyalin on cooked starch minimizes the importance of such a study from the standpoint of acid production by mouth organisms, an investigation of starch would seem to be a logical starting point in this work. There is also the possibility that enzymes produced by mouth organisms play a larger part in the degradation of starch and dextrins than has been supposed.

While it is customary to employ glucose in studies of acid production by organ-

TABLE 1.—ACTION OF MOUTH ORGANISMS ON STARCH IN A SOLID MEDIUM

Organisms	Wheat Starch	Soluble Starch
B. aerogenes	Negative	Very slight action
B. subtilis	Positive	Positive
Saccharomyces cerevisiae	Negative	Negative
B. acidophilus	Negative	Negative
Staphylococcus aureus	Negative	Slight action
Sarcina lutea	Negative	Negative
Staphylococcus albus	Negative	Negative
No. 3	Positive	Positive

Note: Organism No. 3 is a gram-positive spore producing bacillus resembling morphologically B. subtilis organisms, but possessing other characteristics as shown by its action in differential media.

TABLE 2.—ACTION OF MOUTH ORGANISMS ON WHEAT STARCH IN SALIVA MEDIUM*

Organisms	Reducing Sugar as Glucose Mg./100 Cc.	Acid as Cubic Centimeters of 0.1 N Acid/100 Cc.
B. subtilis	400	0.1
B. aerogenes	113	0.2
No. 3	400	2.3
Staphylococcus aureus	100	0.1
B. subtilis and Saccharomyces cerevisiae	266	0.1
Control	109	0.1

*Time, 120 hours.

(From the Northwestern University Dental School, Department of Chemistry.)

(Read before the Section on Therapeutics, Pathology and Research at the Seventy-Second Annual Midwinter Clinic of the Chicago Dental Society, February 18, 1936.)

isms, the use of maltose in the study of acid production by mouth organisms should not be neglected.

On account of the great number and variety of experiments possible in an investigation of this kind, the work reported here is of necessity somewhat limited in scope. It is hoped, however, that the data reported may not only be of some value in the study of the problem of dental caries, but also be a contribution to our knowledge of mouth organisms.

Table 3.—The Action of Mouth Organisms on Soluble Starch in Saliva Medium

Organisms	Reducing Sugar as Glucose Mg./100 Cc.			Acid as Cubic Centimeters of 0.1N Acid/100 Cc.		
	24 Hours	72 Hours	120 Hours	24 Hours	72 Hours	120 Hours
B. subtilis	235	890	1000	0.5	0.4	0.0
B. aerogenes	113	116	120	0.5	0.5	1.2
No. 3	148	500	674	1.00	3.50	4.25
Staphylococcus aureus	121	118	115	0.70	0.50	0.60
Sarcina lutea	113	112	129	0.5	1.00	1.30
B. acidophilus	113	108	104	0.5	0.60	0.5
Saccharomyces cerevisiae	121	116	115	0.75	0.85	0.75
B. subtilis and B. aerogenes	113	183	313	0.75	4.00	4.00
B. subtilis and No. 3	144	328	288	1.75	4.5	4.75
B. subtilis and Saccharomyces cerevisiae	133	668	400	0.5	3.00	4.00
B. subtilis B. acidophilus Saccharomyces cerevisiae	174	266	192 to 600	0.5	0.7 to 17.0	0.6 to 21.00
Control	115	126	118	0.5	0.6	0.65

EXPERIMENTAL

All carbohydrates used were of the highest purity obtainable. The soluble starch and the dextrin were further purified by precipitation from alcoholic solution by means of distilled water. This was done twice.

In all cases, the carbohydrates were sterilized in aqueous solution in an Arnold sterilizer. This method of sterilization, while not entirely satisfactory, leads to less extensive decomposition than does autoclaving. The saliva which was obtained by the chewing of paraffin was sterilized in the same way. In a few experiments, synthetic saliva was used. It was prepared to conform as closely as possible to the analytic findings of Becks[1] and of Updegraff and Lewis.[2] Gastric mucin was used in place of salivary mucin. The p_H of the mixture was about 7.2. Incidentally, the same results were obtained when synthetic saliva was used as when natural saliva was employed.

The preliminary determination of the action of mouth organisms on wheat starch and on soluble starch was made

with the carbohydrates in solid medium. The medium had the following composition:

Water	200 cc.
Disodium phosphate	0.17 gm.
Calcium chloride	0.02 gm.
Magnesium sulfate	0.02 gm.
Ferric chloride	trace
Potassium chloride	trace
Beef broth-peptone-agar	2.0 gm.
Soluble starch or wheat starch	2.0 gm.

The plates containing the medium and inoculated with the various organisms were kept in an incubator for seventy-two hours. At the end of this time, tests were made with Lugol's solution for the presence of starch and erythro-dextrin. The result of several such experiments are recorded in Table 1.

The quantitative study of the action of mouth organisms on wheat starch, soluble starch and dextrin were carried out in the same way. The wheat starch was employed in 1 per cent concentration, the soluble starch in 2 per cent concentration and the dextrin in 10 per cent aqueous concentration. In 50 cc. sterile Erlenmeyer flasks 10 cc. of aqueous carbohydrate solution and 10 cc. of saliva were placed. To this mixture was added a 1 cc. suspension of pure strain organisms in physiologic sodium chloride solution. The mixtures were then incubated at 37° C. At stated intervals, flasks were removed and after 1 cc. of material had been withdrawn for bacteriologic study, the contents were transferred to 50 cc. volumetric flasks and diluted to the mark. Portions of the mixture were centrifuged and titrated with 0.02 normal sodium hydroxide to phenolphthalein, by means of a micro-buret. Some of the clear centrifuged solution was used in the determination of reducing sugars by the Myers and Bailey[3] modification of the Lewis-Benedict method. Instead of blood-sugar tubes, 50 cc. volumetric flasks were em-

TABLE 4.—AVERAGE NUMBER OF PURE CULTURE ORGANISMS IN SOLUBLE STARCH

Organisms	24 Hours	72 Hours	120 Hours
B. subtilis Yeast B. acidophilus	103,040,000	33,600,000	44,800,000
B. subtilis	311,024,000	168,000,000	86,576,000
No. 3	88,928,000	87,360,000	56,640,000
B. aerogenes	390,992,000	404,768,000	616,000,000
Yeast (Saccharomyces cerevisiae)	414,400,000	896,000,000	1,142,400,000
Staphylococcus aureus	96,544,000	604,800,000	141,120,000
B. subtilis B. aerogenes	672,000,000	152,320,000	76,160,000
Yeast B. subtilis	139,216,000	78,400,000	59,808,000
No. 3 B. subtilis	593,600,000	141,120,000	29,120,000
Sarcina lutea	8,960,000	716,800,000	304,640,000
B. acidophilus	640,800,000	560,000,000	

ployed in diluting the solutions after completion of action. Several flasks of glucose of varying concentration were used to serve as comparison controls. During the course of the investigation, it was discovered that long-continued heating with sodium carbonate solution gave erratic results and that the best results were obtained when the concentration of reducing sugar was low.

ilized in the Arnold sterilizer. Subsequently, 5 cc. of 10 per cent maltose and 1 cc. of a suspension of organisms in physiologic sodium chloride solution were added. The tubes were then sealed and placed in a thermostat, provided with a shaking device, and kept at 37°C. At stated intervals, tubes were withdrawn and, after removal of a specimen for bacteriologic examination, the contents

TABLE 5.—ACTION OF MOUTH ORGANISMS ON DEXTRIN IN SALIVA MEDIUM

Organisms	Reducing Sugar as Glucose Mg./100 Cc.			Acid as Cubic Centimeters of 0.1N Acid/100 Cc.		
	24 Hours	72 Hours	120 Hours	24 Hours	72 Hours	120 Hours
B. subtilis	620	1060	2140 to 4000	0.65	0.65	1.00 to 0.00
B. aerogenes	596	640	614	0.65	0.65	1.25
No. 3	620	900	1000	0.75	1.00	4.00
Staphylococcus aureus	600	593	610	1.00	2.30	3.00
Sarcina lutea	600	555	592	0.75	1.20	1.90
B. acidophilus	589	573	568	0.85	0.60	0.75
Saccharomyces cerevisiae	599	621	600	0.5	0.50	0.60
B. subtilis and B. aerogenes	563	622	797	0.70	0.80	1.70
B. subtilis and No. 3	574	905	952 to 2400	1.00	1.4	3.10
B. subtilis and Saccharomyces cerevisiae	620	584	880 to 1600	0.60	0.50	1.00
B. subtilis B. acidophilus Saccharomyces cerevisiae	550	834	522 to 2264	0.5 to 2.5	0.7 to 12.5	0.6 to 23.4
Control	600	606	626	0.5	0.60	0.70

The results obtained are recorded in tables and represent the mean of several determinations with each organism.

The production of acids by the action of mouth organisms on maltose was studied in the following manner: Finely powdered human enamel was placed in pyrex tubes containing 5 cc. of saliva and sterwere analyzed for calcium by the well-known oxalate-permanganate method. The results obtained are shown in Tables 7 and 8.

COMMENT

It was realized at the outset that the degradation of starches of various kinds is an exceedingly complex study and that

the actions of a variety of enzymes on starches give a number of different results.

The particular action studied here may be called saccharification, or the production of reducing sugars from starch. An examination of the tables shows that reducing sugars were present in all of the tubes, including the control. This may be attributed to the method of preparation of soluble starch, the sterilization and the method of analysis. With respect to the last, it should be mentioned that the use of Benedict's quantitative reagent gave somewhat lower, but no more constant, results than were obtained by the method employed in this study.

Of all the organisms studied, *Bacillus subtilis* was the most consistent in its effect, both on wheat starch and on soluble starch. Instead of producing acid, however, there was apparently little change in titration values and, in a few cases, there was some indication of production of basic substances instead.

Organism No. 3 was less consistent in its action than was *B. subtilis.* In some cases, there was apparently no action at all. Whenever this organism did act on starch, there was slight acid production.

When it was discovered that *B. subtilis* is capable of forming reducing sugars from starch in a saliva medium, it was decided to try combinations of this organism with various other organisms which were known to be aciduric. Such experiments were not uniformly successful. The combination which produced the greatest quantity of acid was *B. subtilis, B. acidophilus* and *Saccharomyces cerevisiae.* With this combination of organisms, the production of a large amount of reducing sugars was associated with slight acid production and vice versa.

An examination of the data shows that as far as acid production is concerned,

TABLE 6.—AVERAGE NUMBER OF PURE CULTURE ORGANISMS IN DEXTRIN

Organism	24 Hours	72 Hours	120 Hours
B. subtilis Yeast B. acidophilus	92,064,000	18,816,000	16,576,000
B. subtilis	315,168,000	51,744,000	186,592,000
No. 3		20,832,000	129,248,000
B. aerogenes		107,520,000	419,520,000
Yeast (Saccharomyces cerevisiae)		26,880,000	417,984,000
Staphylococcus aureus		80,640,000	151,200,000
B. subtilis B. aerogenes	386,064,000	62,720,000	388,140,000
No. 3 B. subtilis	320,320,000	21,504,000	68,880,000
Sarcina lutea	11,200,000		483,840,000
B. acidophilus		5,000	8,000

combinations of organisms studied here do not produce so much acid from starch as might be expected from the results obtained for reducing sugars. This may be due to the fact that the reducing sugar produced is not always in a form which can be readily utilized, or it may be that the organisms elaborate antagonistic substances. The latter point is an interesting one and should be investigated. A few preliminary experiments involving *B. subtilis* and *Saccharomyces cerevisiae* indicate that the former inhibits acid production by the latter when the medium contains a large amount of protein material as well as carbohydrate.

The action of organisms on dextrin seems to be somewhat similar to that on starch. As a matter of fact, even the rate of action in many cases is roughly of the same order of magnitude, indicating that soluble starch is hydrolyzed with about the same ease as is dextrin.

It is believed that the procedure used in the studies with maltose gives a fairly accurate picture of the action of aciduric mouth organisms. The results obtained in this study were checked against those found by titration methods and the agreement was good.

Of the organisms studied, *saccharomyces cerevisiae, B. aerogenes,* No. 3 and *Staphylococcus albus* decalcified enamel and the rate of decalcification for these organisms is in the order named. Under the experimental conditions employed, *B. acidophilus* alone caused no decalcification of the powdered enamel, but a combi-

TABLE 7.—DECALCIFICATION BY MOUTH ORGANISMS IN MALTOSE-SALIVA MEDIUM

Organisms	Mg. Calcium per 100 Cc. 4 Hours	Mg. Calcium per 100 Cc. 24 Hours	Mg. Calcium per 100 Cc. 72 Hours	Mg. Calcium per 100 Cc. 96 Hours
Staphylococcus albus	3.2	7.5	18.5	
B. subtilis	3.3	3.2	2.9	2.6
No. 3	3.0	10.0	20.4	
B. aerogenes	3.8	20.2	25.6	31.4
Saccharomyces cerevisiae	3.2	21.0	29.9	89.0
Staphylococcus aureus	3.4	5.9	10.7	17.5
B. acidophilus	3.0	2.7	2.9	
B. aerogenes B. acidophilus	3.5	22.0		75.0
B. acidophilus Saccharomyces cerevisiae	3.5	41.0	110.0	
B. subtilis B. aerogenes	3.5	21.5		23.0
B. subtilis Saccharomyces cerevisiae	4.5	18.0		86.0
Control	3.5	3.0		4.0

nation of *B. acidophilus* with either *B. aerogenes* or *Saccharomyces cerevisiae* produced a rapid and extensive destruction of enamel.

3. A study has been made of the action of some mouth organisms on maltose in a saliva medium.

4. Symbiotic effects have been noted among some of the organisms studied.

TABLE 8.—AVERAGE NUMBER OF PURE CULTURE ORGANISMS IN MALTOSE

Organism	4 Hours	24 Hours	72 Hours	96 Hours
1. Yeast & B. subtilis	259,200,000	89,600,000		124,240,000
2. B. subtilis	103,783,333	58,184,000	22,838,000	94,080,000
3. No. 3	72,016,000	21,896,000	4,016,000	15,680,000
4. B. aerogenes	210,000,000	225,176,000	56,672,000	29,120,000
5. Yeast (Saccharomyces cerevisiae)	16,016,000	41,216,000	20,458,666	560,000,000
6. Staphylococcus aureus	186,712,000	82,208,000	65,856,000	
7. B. subtilis and B. aerogenes	546,560,000	672,000,000		154,560,000
8. Yeast and B. subtilis	241,920,000	224,000,000		64,960,000
9. No. 3 & B. subtilis	129,920,000	69,440,000		67,200,000
10. Staphylococcus albus	10,304,000	27,802,666	27,850,666	
11. Yeast and B. acidophilus	3,136,000	9,408,000	53,984,000	
12. B. acidophilus	2,356,500	624,000	5,000	
13. Sarcina lutea	1,568,000	9,184,000		

CONCLUSION

1. The action of certain mouth organisms and some combinations of organisms on wheat starch and soluble starch has been studied as to acid production and formation of reducing sugar.

2. The action of the same organisms on dextrin has been studied.

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ORAL SEPSIS AND ITS RELATION TO ORTHOPEDIC CONDITIONS

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IT may be considered presumptuous for an orthopedic surgeon to speak to dental surgeons on the subject of oral sepsis and its relation to orthopedic conditions, and yet I have no hesitancy in stating my views on these important pathologic conditions, which concern us both. During the twenty years covering my observations, I have seen the pendulum swing back and forth, the swing back representing the attitude of those who do not believe in the theory of focal infection and who would extract no teeth as local sources of infection affecting the general and remote body mechanisms, and the swing forth representing the attitude of that rather large group who today would remove all non-vital teeth, even without the presence of evident local sypmtoms or of remote secondary symptoms, as a prophylactic or preventive measure. Surely there must be some sane middle ground, level and dry, where a conservative may find a firm foothold. I stand upon this middle ground and propose to give my reasons for favoring conservatism in most cases and radicalism occasionally, but never negligence, in the care of oral sepsis for the prevention and in treatment of certain orthopedic diseases.

In any discussion of focal infection, we always speak of the teeth first, but we must include the tonsils, sinuses, gastro-intestinal tract (bowel, appendix, gall-bladder) and the urogenital tract (prostate, vesicles and cervix).

(Read before the Section on Medical Relations at the Seventy-Third Annual Midwinter Clinic of the Chicago Dental Society, February 16, 1937.)

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ETIOLOGY

The etiology of dental infection concerns itself not only with the pulpless tooth, but also with the diet, hygiene and resistance of the individual and of his ancestors. One must therefore go back not only to the immediate prenatal period, but also several generations in order to prevent dental caries. Weston A. Price, in an exhibit at the American Academy of Orthopaedic Surgeons in Cleveland, in January 1936, showed photographs of African aborigine tribes of a previous generation who had lived on the coarse foods of their locality. Their faces and heads were round and full (brachycephalic) and their teeth perfect or nearly so. The generations succeeding the advent of European nations and their industries, modern modes of living and modern foods, were shown with narrowed faces (dolichocephalic) and malalined carious teeth. This was of extreme interest to me, although I presume that it is, of course, common knowledge to men of your profession. But to me it brings home a point in prophylaxis; namely, that the present generation must be educated more thoroughly by your profession as well as ours, and that propaganda must be widespread regarding choice and preparation of foods. We must not wait for pregnancy before giving dietary and hygienic instruction. At this time, it is too late. May I apologize for this and further reiteration

of information which is so well known to the vast majority of the members of our professions? But permit me to proceed with the understanding which we all have that the repetition of these important points may serve to remind us of our duty to the coming generations as well as to the present one.

It is generally conceded that candy (an excess of cane sugar) and soft, too well prepared foods are contributing factors in degeneration of the dental structures. All of your parents and grandparents warned you against sweets as causing dental decay.

I am told that oral hygiene and brushing of the teeth and gums several times

Fig. 1.—Aseptic bone necrosis of ulna around metal plate and screws.

a day, while important and necessary, will not replace the beneficial effect of eating harder foods.

In addition to heredity and the local oral chemistry and the mechanical factors, the etiologic importance of the systemic metabolism must not be underestimated. The latter includes the questions of calcium and phosphorus metabolism, as well as of the enzyme phosphatase and the vitamins.

DIAGNOSIS

Since dental focal infection starts with either pyorrhea or pulpless teeth, it would be well to consider these conditions separately; and yet, in attempting to diagnose dental focal infection, one must not separate these two. This means that a competent, careful dental examination is as essential as a proper roentgenologic examination. I have often been amused when some of my medical colleagues have looked at a series of dental films and entered on their records "no dental infection." In my own practice, I routinely examine the teeth and throat and secure roentgenograms, but I insist that the actual examination and opinion of a competent dentist is paramount and his judgment is final. Our relations with your profession have been most cordial, and our consultations (either by the phone or, preferably, written) with the dental surgeons of our patients have always permitted us to give the patients the benefit of these conferences.

While we are considering the roentgenologic aspects of the diagnosis of dental sepsis, I cannot refrain from condemnation of those who would venture an opinion based on poorly exposed or poorly developed films or incomplete dental roentgenologic examination. I speak for thorough examination, repeated if necessary from several angles, as in the examination of the skeletal structures elsewhere in the body. And I have been impressed with the importance of bite-wing films for the discovery of early caries. The initial expense may seem excessive, but the ultimate saving in dental work, which is eventually made necessary by careless, insufficient examinations, and the eventual harm done to the patient, is beyond estimation in many cases. I am in favor of periodic check-up roentgenograms. The importance of this is emphasized by the report of Gardner,[1] who states that 33⅓ per cent of patients with full dentures were found to have remaining roots and 20 per cent of patients having extractions elsewhere to have one or more roots left. Concerning pulpless teeth, he states that

94 per cent of teeth shown by the roentgenograms to be diseased gave positive cultures of streptococci.

I am not so certain that apical rarefaction, periodontoclasia or so-called apical granuloma indicates infection in every instance. It reminds me of the osteoporosis around a small area of aseptic bone necrosis which we see surrounding foreign bodies such as screws or nails when used in osteosynthesis of long bones (Fig. 1). Figures 2 and 3 show several areas of apical absorption in which the bone changes may resemble roentgenologically those seen in Figure 1. We know that it is possible to induce recalcification of these areas. In these films, which were kindly lent to me by a dental colleague, the end-result after treatment through the root canals is excellent bony repair.

Why may not some of these areas of osteoporosis be due to the chemicals with which the root canal has been treated plus the irritation of the inert material used in filling the canal or the irritation of the dead tooth root?

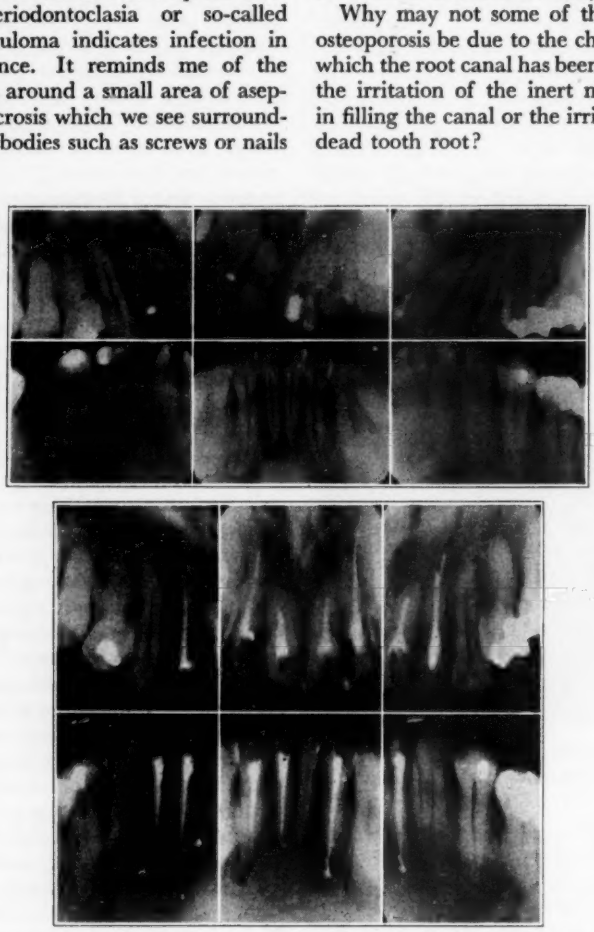

Fig. 2.—Above: Areas of apical rarefaction before treatment. Below: Areas after treatment, showing recalcification.

There is no question in my mind that the incidence of infection in surgery may be directly proportionate to the number of dressings used, all other circumstances being equal. Therefore, it seems logical, to me at least, that, regardless of careful

technic, the more frequently the root canal and apex of the tooth is treated, the more likely is it to become infected; and the incidence of infection should be directly proportionate to the carelessness of technic. It has, therefore, been very difficult for me to understand why certain dentists whom I have heard called the "cotton brigade" treat teeth for many weeks and even months before inserting the final material, at which time many of these teeth are ready for extraction.

In the reading of roentgenograms, Gardner[1] has shown that attention should be directed also to the skeletal structures of the mouth. We may find evidence of a generalized bone demineralization,

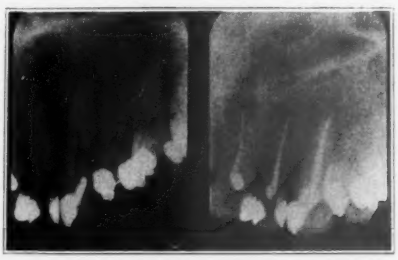

Fig. 3.—Apical rarefaction similar to that shown in Figure 2. Left: Before treatment. Right: After treatment.

which may be due to inadequate diet or to poor general condition. These cases require the administration of a diet containing an adequate amount of vitamins, particularly vitamin D, and of calcium and phosphorus in proper proportion, augmented by calcium phosphate and vitamin D.

With regard to the electrical tests and other methods of diagnosis of dental infection, I merely mention them for the sake of thoroughness before proceeding with the discussion of oral sepsis and its relation to orthopedic conditions.

The modern dentist is no longer considered as a mere mechanic who extracts teeth and then restores carious portions of them or repairs them by ingenious devices and materials. By the term modern dentist, I mean the men in general practice and not the smaller body of highly trained exodontists who are usually merely consultants carrying out what their judgment and that of the referring dentist prescribes. This modern dentist must be a diagnostician who not only estimates the local carious, gingival and focal condition of his patient, but must also correlate his findings with those regarding the general physical condition of the patient. This can be accomplished only by teamwork between our professions. My experience and contact with the dentists of my patients have almost without exception been most pleasant and to the best interests of our common patients. May I repeat

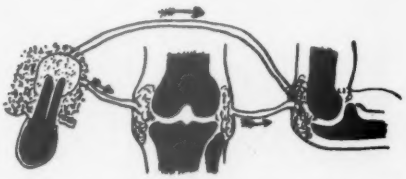

Fig. 4.—Sketch showing how, even when elimination of the primary focus in chronic arthritis has helped arrest the condition or rendered its subsequent attacks less severe, an old secondary infection of the synovial membrane or prostate may act as a "feeder."

that the final judgment regarding extractions, and in fact all dental work, should always rest with the dentist, and it is my opinion that any contrary procedure is presumptuous. It is true that, in some instances, dental consultations are necessary before making momentous decisions regarding extractions, just as surgical and medical consultations may be necessary in our work before proceeding with some important method of treatment. Jones and Lovett,[2] as well as numerous other writers, stress the importance of medical and dental cooperation.

The orthopedic lesions which may result from focal infection are: arthritis, synovitis, periarthritis, fasciitis, periostitis, phlebitis, myositis, tenosynovitis, bursitis, osteomyelitis and neuritis or neuralgia.

The consensus of opinion of those who treat arthritis is that focal infection is a most important factor in the etiology of atrophic (rheumatoid) arthritis, and of lesser importance in hypertrophic arthritis (osteoarthritis), but since many cases present elements of both, *i.e.*, a mixed form of arthritis, the etiologic factors must often, if not always, be related. Therefore, it is very evident that the most

Fig. 5.—Hypertrophied synovial mass removed from left knee of Patient J. P. in case of infective synovitis. (Centimeter rule shown below.)

important etiologic factors must be eliminated in the treatment of the arthritides, and it is also very evident that the earlier the causative factor or factors are eliminated, the better will be the opportunity of eliminating the disease before it gains a foothold.

It has seemed to me that the situation may be somewhat analogous to that of a defective bearing in an automobile. If such a condition is discovered early, the bearing can be easily replaced and the engine will function properly. If, however, it is neglected, the other bearings and functioning parts will gradually begin to give trouble, so that a complete overhauling becomes necessary, and even after this procedure, the car often does not give satisfactory service.

In the arthritides, removal of infected foci may aid, not only in preventing further and continued reinfection of the symptom-producing joints, but also in building up the general resistance of the patient so that his own immunity-producing forces can better overcome any residual infection in the system.

There is no question in my mind that since the memorable work of Benjamin Rush, Billings and Rosenow, innumerable focal infections have been eliminated without material improvement of the immediate complaint of the patient. On the other hand, if our records would permit a proper evaluation of the remote benefits to our patients physically, as well as a numerical classification of those in whom disease was immediately arrested, improved or cured, these numbers would be impressive. It may be difficult, at times, for a physician or a dentist to explain the almost dramatic cure of a patient following extraction of teeth or removal of tonsils, but more often it is very embarrassing and difficult to explain the lack of improvement to certain patients after the elimination of one or more foci. It is not difficult for me, however, for I have a rather definite approach to the problem, for which no originality is claimed.

Given a patient with arthritis or some other remote manifestation of a probable focal infection, it is my custom to secure a definite history as to the duration of symptoms. If they have been prolonged, we may not reasonably expect that removal of the suspected primary etiologic factor will cure the patient. Nevertheless, the circumstances are explained to the patient and if possible to the relatives.

The removal of evident focal infection is necessary. There may be secondary foci or associated foci some of which cannot be removed. For example, the hypertrophied synovial membrane of a knee joint may act as a secondary focus and from it other joints may be involved even after the original focus has been removed (Fig. 4). There may be a secondary focus in the prostate or gallbladder or associated or contributing foci in the bowels, tonsils, sinuses, etc. Our approach, therefore, should be elimination of the most accessible foci first.

Careful attention is given to the bowels. I shall never forget Dr. John Ridlon's admonition to me nineteen years ago: "Whenever you have a case of arthritis, before you do anything radical, see what a little senna tea will do for the patient." Dr. Robert Osgood told us many years ago of the almost miraculous cure of some arthritic patients after cleansing of the alimentary tract. We are frequently told by patients that their joint pains are worse when they are constipated. Of course, we must always consider the fact that deficient body function reduces appetite and impairs the general resistance so that the infection or its products may make the remote symptoms more noticeable.

Having regulated the bowels, eliminated prostatic or endocervical infection and ruled out sinusitis, our suspicions are next directed to the tonsils. My medical colleagues doing that special work bend backward in their attempts to avoid enucleation of tonsils which "appear innocent." But, given a history of recurrent tonsillitis or peritonsillar abscesses, I usually insist on removal of such tonsils regardless of their superficial appearance of innocence. On several occasions, I have seen perfectly innocent looking tonsils with abscesses beneath them, the latter becoming evident as the tonsil is being removed. I feel certain that it is the enclosed infection of any focus which produces remote symptoms. For example, in a case of chronic osteomyelitis with a residual draining sinus, there are no general symptoms until the sinus becomes plugged or a new enclosed area of

Fig. 6.—Case referred to in Figure 5. The legs of the patient when standing and when squatting are shown. Synovectomy for infective synovitis was performed on the left knee about eighteen months previously and on the right knee six months later.

bone becomes involved, and then we have constitutional symptoms, which are again relieved when drainage has been established.

The first possible focus which we discuss with the patient, the teeth, is usually the last one which we attack by our system of elimination. When the bowel, genito-urinary and gynecologic investigations are completed and the infected tonsils have been removed and cultured, and the dental surgeon reports infected or possibly infected teeth or gums, it becomes necessary to attack these important dental structures. Frankly infected teeth are extracted at the proper time with aseptic technic, and the apical canals and periapical areas are cultured.

Following is the technic usually employed in the bacteriologic laboratory at Michael Reese Hospital:

The teeth are placed in a tube containing 1 per cent sodium carbonate solution, which inhibits the growth of other bacteria than the streptococcus. From this tube, cultures are made in beef heart-dextrose and ascites-dextrose broths, and on blood-agar plates. The interiors of the teeth are cultured by crushing the teeth and streaking the material on blood-agar plates.

My greatest difficulty with members

Fig. 7.—Osteomyelitis of left leg. There are two large sinus openings. Healing began promptly after oral infection was eliminated.

of the dental profession in general practice has been to secure, as far as possible, early uncontaminated cultures. Perhaps I am more concerned about this than others because I am one of those who believe that vaccines, stock or preferably autogenous, combined with all other remedial agents for arthritis and related or similar diseases, should be part of the treatment. To extract a tooth or remove a tonsil and throw it into the bucket is neither scientific nor conducive to the best interests of the patient. Likewise, to remove a tooth without aseptic technic and without either special culture media at hand or a sterile container for immediate transmission to a qualified laboratory is poor technic. I have had dentists remove a tooth in the late afternoon and send it to my office the following day with the request that I send it to my favorite laboratory. Such circumstances should not arise, and every dentist should know how to remove a tooth without contamination; how to make cultures from the apical canal as well as the periapical area, and how to amputate the root with a sterile disk and drop it directly into a sterile container. He should know that he should send it immediately to a good laboratory for culture and to obtain a vaccine.

I have kept on my shelves in my refrigerator dozens of vaccines made from and for patients with joint complaints who never required vaccine because they were improved or cured by the elimination of focal infection plus the general treatment. Eventually, I have thrown these vaccines away. On the other hand, I have seen some excellent and even dramatic results following the elimination of such focal infection and the use of the autogenous vaccine combined with the usual indicated methods of treatment of the joint complaints. In some cases, we are at a loss when a culture and vaccine has not been made, so that it is always our policy to make such a culture and vaccine from removed foci with the hope that their elimination will help to cure the patient and that the vaccine may not be necessary. The cultural report is always of scientific interest.

Infected teeth should be removed only after the acute inflammatory joint symp-

Fig. 8.—Mouth of patient referred to in Figure 7. Severe gingival and apical infection were present.

Fig. 9.—Arthritic deformity of hand with ulnar deviation of fingers in Patient F. W. Left: Before operation. Right: After correction by resection of second, third, fourth and fifth metacarpal heads.

toms have subsided and the patient is in the best possible general condition. This point has been stressed by numerous writers and was again emphasized in the "Report of the Committee on Arthritis" of the American Academy of Orthopaedic Surgeons, January 11, 1937.[3]

What has been said above in reference to arthritis is more or less true of the various related conditions which I have enumerated.

Infective synovitis is in fact a form of arthritis involving the synovia or parietal lining of the joint. It may be associated with involvement of the joint surfaces, the degree of involvement depending on the type and duration of the disease. Figure 5 represents the hypertrophied synovial mass removed from a patient after elimination of focal infection and local and general arthritic treatment. Within six months after removal of this mass of tissue from his worse knee, the left, he returned to the Mandel Clinic with the request that the same type of operation be done on his right knee, because the first knee which was operated on felt normal.

Periarthritis, an inflammatory condition in the capsule of the joint, most frequently seen in the shoulder, is treated focally like arthritis, but locally it usually requires gentle manipulation to separate the fine adhesions of the reduplicated capsule, followed by intensive well-supervised physical therapy.

Myositis and tenosynovitis, muscle and tendon sheath inflammations and neuritis or neuralgia are also treated like arthritis from the standpoint of focal infection.

Bursitis, inflammation of a bursal sac, occurs most frequently in the subdeltoid or subacromial bursa. It is usually associated with a periarthritis or arthritis of the shoulder and the acute cases are extremely painful and disabling. It has been my pleasant experience to have a series of these patients with hot, tender, calcified bursae and who had frequent recurrences completely relieved by physical therapy and sedatives, and when the acute symptoms have subsided, I have had their evident focal infections (of teeth or tonsils) eliminated and have had no recurrence.

Acute osteomyelitis of the hematogenous type is usually due to a trauma with a *locus minoris resistentiae,* following furunculosis, tonsillitis or exanthemas. An example of acute osteomyelitis of the tibia following an injury in a patient with a very severe type of dental infection, gingival and apical, is shown in Figure 7. This case speaks for the necessity of prophylaxis.

This man was seen by me years after his acute bone infection had subsided, presenting several draining sinuses from chronic osteomyelitis. Numerous surgical procedures had failed to clear up the local infection. Several months ago, his infected teeth were extracted, and shortly afterwards his sinuses began closing.

Fasciitis and periostitis are not infrequently encountered, particularly in the lower extremities. The plantar fascia, the lateral aspects of the os calcis, and the anteromedial surface of the tibia, the usual sites of tenderness, may be associated with general arthritic symptoms. Improvement is obtained by proper local protection and physiotherapy, with the administration of analgesic medication. Recurrences are prevented by the properly timed eradication of infectious foci. Phlebitis is seen as a chronic or recurring inflammation of the veins. It may persist or recur despite all local measures until focal infection has been eliminated.

The end-results of some improperly treated joint conditions are shown in Figure 9. These deformities could have been prevented by proper orthopedic management, and the underlying causes may have lain in accessible and eradicable infectious foci. If such patients could be given, at an early period, the benefit of adequate medical and dental cooperation,

much needless suffering and disability could be obviated.

SUMMARY AND CONCLUSIONS

I have presented certain orthopedic conditions which can originate from one or more remote foci of infection. Dental infection often plays an important rôle in the etiology of these diseases, but is only one of many factors which may be involved. Extraction of infected teeth is often of great value in the treatment, but must not be resorted to indiscriminately. I have attempted to explain why, under certain conditions, even the removal of etiologically concerned infected foci may not result in cure. Continued cooperation between dentists and physicians is essential for the welfare of the patient.

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AUTOVACCINATION

By Thomas B. Hartzell, M.D., D.D.S., Minneapolis, Minn.

BY the title, "Autovaccination," I mean to imply vaccination from the patient's own lesions.

Jenner was the first man in the world's history to successfully protect the individual from smallpox by the process which we continue to use and to call vaccination; *i. e.*, the inoculation of a person with pus obtained from the pustule of a cow or from a pustule on the body of a human being who has been successfully vaccinated or inoculated with cowpox or vaccinia.

Napoleon, it is said, learning of the value of smallpox vaccination, had a whole army corps thus protected, for he believed that smallpox killed more men than bullets.

Since the time of Jenner, the principle established by him has been utilized in many ways. A great impetus was given to the application of this principle by Pasteur, who definitely laid down the law that there is a specific micro-organism for every known disease. He saved the cattle industry for France through his knowledge, experimentally gained by immunizing cattle to anthrax; he also immunized chickens to cholera.

The subject of immunity and immunization is not within the scope of this paper, nor is it my intention to attempt a bibliography at this time.

For years, I have striven to protect human beings by immunizing them to the streptococci that grow on the sides of teeth, from which location they migrate into the circulation and do great harm. Notwithstanding the time and years spent to secure a laboratory-made vaccine, this effort has been comparatively worthless.

The reason, I believe, is that bacteria found on the sides of teeth or in pyorrhea pockets or in dental abscesses, when transplanted to laboratory media, do not produce the same active poisons and ferments that they do in the site of infection in the human body; hence, when they are

made sterile by heat and returned to the body, they fail to promote the creation of antibodies.

My own records show that I have guided the treatment of more than twenty-five thousand cases of gum and tooth infection. This was made possible by a generous practice and by service on the staffs of four great hospitals, as well as the University Clinic, for a period of thirty-five years. My first striking observation taught me that it was extremely dangerous to the life of patients, particularly those whose resistance was low, to treat more than one or two infected teeth at one time, for I have seen, when much interference with these infections was permitted, septicemia, pneumonia and acute inflammatory arthritis ensue.

On the other hand, when comparatively little treatment was given at one time, five to seven days elapsing before the next treatment, the resistance of the majority of patients was strengthened and complete recovery from secondary infections and local lesions followed provided further invasion of the mouth tissues was prevented.

This, I believe, is due to two things: reduction of invasion and stimulation of antibody production, resulting in increased energy, freedom from pain and, in many instances, tremendous increases in both the red and the white cell counts.

Experience has also taught me that in cases where the modern method of shearing away infected gum tissue is followed, these benefits are not obtained. Failure to receive these secondary benefits is due, I believe, to the loss of the autovaccinating power that slower methods of treatment make possible. Therefore, I follow the slower methods and, in case the patient does not show increased vitality and improvement in secondary infections at the time treatment should ordinarily close, I do not shear away all unhealable tissue around the teeth, but allow two or three such areas to remain untouched for a time. At suitable intervals, I thrust a smooth probe into such pockets and deliberately rub the inside of the pocket back and forth with a smooth flat instrument, thereby administering continued doses of living bacteria from the pus pockets.

By these methods of treatment, I have obtained relief from pain and repair of both primary and secondary lesions. This satisfactory result is absolutely dependent upon the prevention of bacterial accumulation on the sides of teeth by removal of these germs morning and evening and the vigorous stimulation of the circulation in the tissues surrounding the teeth by friction, preferably with half-inch No. 4 Johnson & Johnson cotton rolls held in a six-inch curved hemostat and interdental cleansing with stimulants or cotton-wrapped toothpicks. If teeth are so spaced as to allow the bristles of a stiff toothbrush to be inserted between them they do the work very well. When one-row brushes are used, the handle of the brush should be thrust forward and back without allowing the bristles to escape from the interdental spaces and at the same time bearing down upon these bristles to make pressure on the soft tissues retract the gum. This enables one's patients to reach many bacteria that otherwise would not be removed because they are concealed under the gum edges.

When speaking of pain relief I was referring to the pain suffered from neuritis or arthritis, as there seldom is pain resultant from even deep pyorrhea pockets.

Of course we all know that no method is absolutely without fault. However, this method has yielded a greater measure of success than any other with which I am acquainted.

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CARIES CONTROL DURING CHILDHOOD

By George W. Teuscher, D.D.S., M.S.D., Chicago, Ill.

CONTROL of dental caries means necessarily some knowledge of its cause, at least enough that we can point to certain apparent factors in its control. As far back as 1530, a German author attempted an explanation of dental decay; and, ever since, dentists and research workers have endeavored to point out the cause of this disease. Many theories and opinions have been propounded and there seems little doubt that when the cause is finally discovered, there will be many factors involved. Our recent knowledge points very definitely to that.

There are three major theories of the cause of dental caries: the nutritional, the local, which has been elaborated on the chemicobacterial theory, and the theory that both nutritional and local conditions play a part. Mellanby,[1] Rosebury[2] and Jones[3] are exponents of the nutritional theory, and G. V. Black,[4] Miller,[5] Williams[6] and Bodecker[7] were adherents of the theory that the saliva is solely responsible for dental caries. Whether one belongs to the latter school or to the third school of thought is a matter of point of view. Many adherents of the third theory believe that the action is always a local one, but that the saliva may be affected by dietary and other conditions. Arthur D. Black, Fosdick, Hansen and Bunting are adherents of this theory.

Tribute should be paid to those who added their contributions to a clear description of the caries process, which culminated in the establishment by G. V. Black of his principle of extension for prevention. Caries consists mainly of a chemical dissolution of the calcium salts of the tooth structure by lactic acid. It is a process which begins always outside the tooth; never within. Consequently, research workers must be concerned with the environment of the teeth or, more specifically, with those conditions which have to do with the application of acid to the surface of the enamel in such a way that the tooth structure is destroyed.

The following detailed description of the process of dental decay is quoted from Black[8]:

> Caries of enamel is caused by an acid formed by microorganisms under the following conditions: (1) The organisms are attached to or lie upon the outside of the enamel. They grow and form the acid which causes caries of enamel in that position. They never enter the tissue until the enamel rods are loosened and fall out. The enamel is a solid into which microorganisms cannot penetrate. (2) The enamel rods are cemented together by a cementing substance which dissolves more readily in an acid than the rods themselves, and first effect upon the enamel is to dissolve out this cementing substance. The general rule is that in decays occurring in the smooth surfaces of the teeth, this cementing substance is dissolved through the entire thickness of the enamel before any enamel rods fall way. In some of the decays involving the pits, the enamel rods themselves will be dissolved, enlarging the pit. (3) The decaying spot upon the enamel is always whitened, as the first observable change. This change in color is sometimes not considerable and is very easily overlooked while the teeth are wet, but, when the teeth are dried and examined carefully, the color will be found to be a grayish white, or even very white in some cases, and the outlines are often very clearly marked. (4) In such spots an explorer is likely to catch if passed lightly over the sur-

(Read before the Section on Children's Dentistry–Mouth Hygiene at the Seventy-Third Annual Midwinter Clinic of the Chicago Dental Society, February 18, 1937.)

face, instead of gliding smoothly as it will on sound enamel. (5) For these decays to occur, it seems necessary that microorganisms become attached to the surface of the tooth, grow there in the form of a colony, attached together in a gelatinoid matrix, or equivalent covering, and produce fermentative decomposition with acid formation at the spot, applying the acid directly to the solution of the tooth. (6) For this reason, the beginning of caries of the teeth occurs at such points as will favor such lodgement or attachment in which the microorganisms will not be subject to such frequent dislodgement as would prevent a fairly continuous growth. This explains the localization of the beginnings of caries on particular parts of the surface of the tooth.

This description is given here to present a mental picture of the problem involved. To control caries, effort must be directed toward the prevention or the elimination of the conditions mentioned above. Fosdick and Hansen, at Northwestern University, and Bunting, at Michigan, have shown that the number of aciduric bacteria is greater as the susceptibility of a person to dental decay increases. Therefore, anything that contributes to stagnation or will permit bacteria to multiply more rapidly should cause caries.

What are some of the variable factors that might contribute to such a condition? We know that a satisfactory occlusion, proper cavity preparation, proper placing and finishing of fillings, a healthful condition of the saliva, the occasional and careful use of silver nitrate and attention to diet and other fundamental necessities of life are factors in controlling dental caries. Each of these has commanded the attention of the experienced and learned worker and much space has been consumed in writing of them. They are all important and, under present conditions, each must be given attention in a program of caries control. Satisfactory occlusion means normal function in mastication, preventing tipping and movement of the teeth into abnormal positions. It assures us of a minimum of food packing against the surfaces of the teeth, and a maximum of natural cleansing.

Improperly extended cavities in the very susceptible mouth and in the unclean mouth mean early recurrence of decay and possible loss of the pulp. This is not a paper on cavity preparation, but I cannot overlook the opportunity to point out the apparent necessity of careful attention to it. The principle of extension for prevention of recurrence of decay has been supported by years of clinical evidence that leaves little room to doubt its efficacy. It, no doubt, constitutes the most effective means of controlling dental caries when once cavities have developed. Loose or broken fillings are often caused by carelessness in cavity preparation. They may result in the entire destruction of the tooth if not discovered early. The result of failure to remove all carious tooth structure from a cavity is common knowledge to all.

In recent years, good work has been done with silver nitrate. Howe, of Boston, and Prime, of Omaha, have pointed out many possibilities of its use. Sufficient data have not been gathered to show whether it penetrates completely a mass of carious dentin, or to show what effect it has on the pulp. Work on these subjects is in progress. There is danger, of course, that silver nitrate might come to be used indiscriminately. Probably this has already happened in the hands of certain operators. Carefully and wisely used, it helps to control dental caries.

Suppose that I have prepared a cavity in the distal surface of a deciduous first molar (Fig. 1). Before I place a matrix for the filling of that cavity, I immunize the mesial surface of the second deciduous molar with silver nitrate, applied with a few cotton fibers wrapped on a broach. This application is followed with eugenol. Warm air is again used and the entire operation repeated. Areas of beginning decalcification can be immunized for the period that the silver nitrate remains, which is anywhere from six months to a

year. At the end of that period, the procedure can be repeated. Such practice does not, however, immunize the enamel surface immediately surrounding the area of decalcification. Silver nitrate has no lasting effect on sound enamel. The decalcified area must be present to retain the precipitated colloidal metallic silver.

When silver nitrate is reduced with the proper reagents, a fine deposit of metallic silver results. The presence of the colloid on the tooth surface prevents the formation of lactic acid. The knowledge that this reaction takes place has been applied for many years outside the field of dentistry. It has recently been given many commercial applications. Water in swimming tanks is kept sterile by an electroprecipitation of colloidal metallic silver. This is accomplished by permitting it to flow across a series of silver bars carrying a current. A portable sterilizer for drinking water, consisting of a small flashlight dry cell with silver electrodes, is used by fishermen and hunters to sterilize spring water for drinking purposes.

Fig. 1.—Application of silver nitrate to the proximal surface of a deciduous molar. (From Black's Operative Dentistry.)

Referring again to the deciduous molars, allow me to describe a procedure which can be extremely effective. Arthur D. Black[9] describes the control exercised by widening the embrasures between the first and second deciduous molars and the first permanent molars. Many deciduous molars have broad, flat proximal surfaces, and some of them even concave proximal surfaces, with resultant flat contacts and small embrasures. Such conditions prevent the normal cleanliness resulting from excursion of food substances over the angles of the teeth. The angles of the deciduous molars are therefore rounded with sandpaper disks. The contact, which is to remain, is left untouched. Silver nitrate is then applied to the ground surfaces of the enamel.

A few years ago, Prime, of Omaha, applied and precipitated silver nitrate on the proximal surfaces of the upper anterior permanent teeth of more than one hundred young people, a majority of them children. In only two mouths was it found that there had been no decalcification on any of the proximal surfaces. The others showed at least one proximal surface with beginning decalcification of the enamel. Many of those beginning cavities were not detectable with the explorer. In such cases, the silver nitrate acts not only as a means of immunization, but also as a disclosing agent. I wonder what the percentage of freedom from beginning decalcification would be in the mouths of the young people represented by those of us present today. There are other similar uses for silver nitrate in controlling caries for our child patients.

Fig. 2.—Widening the embrasures and narrowing the contacts to insure better cleansing of the proximal surfaces. (From Black's Operative Dentistry.)

The salivary glands have excretory as well as secretory functions and hence many variations. You will recall that it is desirable to avoid the retention of lactic acid against a tooth surface. A ropy saliva does not have the cleansing effect that a watery saliva has. The mucin content is probably constant, but the lesser quantity of the serous portion accounts for the ropiness of some saliva.

The presence of certain appliances, such as orthodontic bands or wires, interferes with the natural flow of the saliva over the teeth. Children wearing these appliances should be instructed to use the

toothbrush in such a manner that the decrease in salivary flow is compensated.

It is possible that the saliva carries an excretion that may be detrimental to the teeth. This has been suggested as a cause of the apparent increase in susceptibility of pregnant women to dental caries.

The salivary flow in some persons is slower than in others, and it has been found that those with a slow salivary flow are more susceptible to dental caries than those with a more rapid flow. Hence, those with a slow flow should be more scrupulous in their care of the mouth.

It is logical to suppose that attention to the general health will at least aid in maintaining better mouth health. We should not overlook the fact that the mouth with its contents is an integral part of a system. The parts of that system are so closely related that the failure of one must mean at least partial interference with the functions of the others.

If we could predict with certainty the susceptibility of the individual to dental caries before the carious process was actually evident, what an opportunity we should have to control decay of the teeth in that person. Further, it would enable us to study the effects of various foods and combinations of foods on the susceptibility of human beings to dental caries. The study could be made on human material, the determinations being made before decay actually appeared in the teeth of the person subject to the experiments. To some, that may sound fantastic, but science is reasonably close to establishing the procedure for such a test.

Blayney and his co-workers made examinations of stained smears taken from tooth surfaces after these surfaces had been cleaned with a stream of water and dried. They also examined bacterial growths attached to the surfaces of decaying enamel. In the scrapings taken from these surfaces, diplococci and short rod forms of micro-organisms predominated. Micro-organisms were found in all scrapings taken from sound surfaces, but none of the above-mentioned types. They were also relatively scarce in the mouths of persons who were immune to dental caries. Blayney and his workers, therefore, considered the presence of many of the particular diplococci and short rod forms an index of susceptibility. The difficulty of such a test is that the susceptibility of each probable area to decay would have to be determined in each mouth.

Karshan,[10] of New York, showed that the saliva of persons who were caries-free or in whom caries was arrested differed from that of the active-caries group in that both of the former had significantly higher carbon dioxide capacity, and higher percentages of calcium removed and lower percentages of phosphate removed by shaking saliva with tricalcium phosphate.

Fosdick and Hansen,[11] of Northwestern University, have developed a method of measuring chemically the susceptibility to dental caries. It is not appropriate at this time to go into great detail about the chemical reactions involved in such a test. The flow of saliva is stimulated by chewing gum and a measured amount of saliva, which now contains sugar, is collected and to it is added a portion of ground tooth substance. After four hours at body temperature, the amount of decalcification resulting from the action of the saliva is measured, and this determines the chemical susceptibility of the patient.

In young persons, then, it will soon be possible to determine the chemical susceptibility before the clinical signs of dental decay are apparent. Such knowledge gives us an opportunity to prepare the patient for the years when cavities may appear. If instead of dismissing with a wave of the hand the patient who has no cavities, and complimenting him on his good luck, we determine his susceptibility, we can then tell him what will probably happen if certain precautions are not taken. Many gingival third cavi-

ties would have been prevented in the past if such a patient had been made aware of his susceptibility to dental decay before these cavities had developed. People become careless if they think that a particular disease cannot affect them. We can add to such carelessness by thoughtless remarks.

If it were known that a child of four years who had not as yet developed cavities was susceptible to dental decay, a stringent program of oral care and a strict dietary could be set up for him. I would be particularly desirous of removing from his diet any excess of candies, sugary desserts, cookies, etc. This statement is based on work that Dr. Fosdick and I did on the retention of reducing sugars in the mixed saliva after the mastication of carbohydrates. Tests were made on eighty-five boys immediately after their meals, which were of the usual type, and after eating candy. A definite correlation was found between the chemical and clinical susceptibilities and the length of time the sugar was retained in the saliva. The greater the susceptibility to dental caries, the longer the retention of sugar in the saliva, as shown in the accompanying table.

COMPARISON OF ARITHMETIC AVERAGES FOR THREE GROUPS OF CHEMICALLY SUSCEPTIBLE CASES

Time	*10 min.*	*20 min.*	*30 min.*	*40 min.*	*50 min.*	*60 min.*
S.S.*	+1.75	+ .84	+.33	+.09	+.09	.0
S.	+2.38	+1.10	+.74	+.43	+.32	+.02
V.S.	+3.36	+1.50	+.91	+.73	+.55	.0

*S.S.—slightly susceptible. S.—susceptible. V.S.—very susceptible.

COMPARISON OF ARITHMETIC AVERAGES OF FOUR GROUPS OF CLINICALLY SUSCEPTIBLE CASES

Time	*10 min.*	*20 min.*	*30 min.*	*40 min.*	*50 min.*	*60 min.*
(0-10)*	+2	+1	+1	+.33	+.17	0
(10-20)	+2.54	+1.04	+ .80	+.48	+.36	+ .04
(20-30)	+2.73	+1.12	+ .71	+.42	+.38	0
(30)	+3.33	+1.50	+ .66	+.44	+.39	0

* (0-10) No cavities or fillings to ten cavities and fillings.
(10-20) Ten to twenty cavities and fillings.
(20-30) Twenty to thirty cavities and fillings.
(30) Thirty or more cavities or fillings.

May I make a suggestion at this point that I consider of great importance? If you wish a child to refrain from eating anything that he is in the habit of eating, you must suggest a substitute. It is not enough to ask him to stop eating candy: you must suggest something to take the place of the candy. I ask the child to substitute any fruit or nuts for candy for a period of ten days. If he will do that, he will lose much of his desire for candy.

The second thing I wish the susceptible child to do is to add vitamins A and D to his diet. Preliminary experiments indicate that this is beneficial.

The patient must also keep his mouth clean. Today, most of us use a toothbrush for that purpose. The use of the toothbrush is an important factor in caries control. If I wish a child to brush his teeth, I do not scold and nag him and I caution his parents to have patience with him, pointing out the necessity of furnishing him with the necessary equipment for keeping his mouth clean. Proper brushing of teeth, like anything else, should be taught slowly and carefully, the teacher making sure that the child understands what is said to him. Take the opportunity of several visits to teach him the importance of mouth cleanliness and how to accomplish it. Impress him with

the importance of a clean mouth and not with the use of the toothbrush. The latter is only a means to an end.

Such a program is easily submitted to a child and his parents. Will they cooperate? Will they return for periodic examinations and checkups? That will depend to some extent on the child and his parents and to some extent on you. Your approach and your manner of presenting the program will be of importance. A principle in gaining cooperation of a child is to make him a definite part of the program, allow him a part in its formation even though you exercise the guiding hand. People do those things which they themselves have planned or have helped to plan. You might prescribe the finest program possible for a child patient, putting it in writing and explaining every step of it, and the chances of his carrying it out will be very small, simply because he had no part in its formation.

If, instead of saying to a child that he is to eat fruit instead of candy, I ask him whether he would be willing to eat fruit instead of candy, the chances are good that he will follow the suggestion. If, instead of commanding him to brush his teeth, I explain to him why a clean mouth is desirable, his curiosity and interest will be aroused, and I shall probably have some success with a toothbrushing drill.

Cooperation is important. No treatment can succeed without it. I have in mind two cases from practice. Both patients are girls, thirteen years of age. I shall refer to one as A and the other as B. They came in for examination about the same time, approximately fourteen months ago. A had nine proximal cavities and B twelve cavities of the same class. The dietaries of both patients were good except for large intakes of sugar in the forms of candy and sugary desserts. In both cases, the patients were asked if they would be able and willing to do without a certain amount of those particular food substances. They both thought they could. It was then suggested that when they felt the urge to eat candy, they eat a piece of fruit or some nuts instead. Each was willing to try such a program for thirty days.

A was anxious about her weight. When vitamin A and vitamin D were advised as a part of the program, she hesitated, saying she was sure the vitamins would make her fat. I told her I was quite sure the elimination of candy and other sweets would more than balance the vitamins A and D. A consented to try it for one month. I told her if she had gained in weight at the end of the month, we would drop the program without another word about it. To her amazement and joy, she had lost four pounds at the end of the thirty-day period.

The program was presented to B, with her mother present, in about the same way as to A. They left the office with enthusiasm and an apparent willingness to cooperate. B comes in on time for periodic examinations and admits rather reluctantly that she has not followed the program faithfully, and her mouth shows it. Each examination shows several new cavities. Each time the mother becomes frantic and in despair regarding the future of her daughter's mouth. Why cooperation is not forthcoming, I am at a loss to say.

Other parallels could be cited, but each would show the same thing. I realize the need of patient and parent cooperation and I am sure most of you do. Without it, we are doomed to at least partial failure.

How many times do we fill cavities for children and then attempt to alter favorably the conditions that contributed to the formation of these cavities? No longer can we say that we know nothing of dental caries and thus resign our patients and ourselves to fate.

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DIAGNOSIS AND TREATMENT OF FACIAL PAIN OF NON-DENTAL ORIGIN

By Stuart N. Rowe, M.D., Pittsburgh, Pa.

It is generally believed, and quite correctly, that most pain in the region of the face has its origin in defects of the teeth. As a result, most persons with such a symptom first consult their dentist. Usually, the source of the difficulty is dental, and is readily found and successfully treated. Sometimes, however, careful clinical and roentgen-ray study fails to reveal any pathologic dental condition, nor does repair of defective teeth stop the patient's discomfort. What, then, are the other possible causes of facial pain? What treatment is available? What prospect of relief may be presented to the patient? These are the problems which I should like to discuss briefly.

As a preliminary step, it may be helpful to review for a moment the nerve supply of the face. As you know, the seventh cranial, or facial, nerve supplies motor impulses to all of the muscles of the face except the muscles controlling the mandible, and probably carries deep pressure sensation from the face. The fifth cranial, or trigeminal, nerve carries all other forms of sensation from the entire face and supplies motor impulses to the muscles of mastication: masseter, temporal and pterygoid.

This nerve is given off from the brain stem at the upper border of the pons in two divisions or roots, the larger a sensory root, and the smaller a motor root, which extend across the subarachnoid space to reach the trigeminal ganglion lying on the floor of the middle fossa of the skull at the medial end of the petrous ridge. The ganglion gives off three peripheral divisions or branches, the first, or ophthalmic, supplying the forehead and eye; the second, or maxillary, supplying the temple, cheek, upper jaw, upper teeth and upper lip, and the third, or mandibular, supplying the lower jaw, lower teeth and lower lip, each passing out of the skull through a separate opening close to the ganglion. It is important to remember also that injury, severing or avulsing a portion of the nerve peripherally to the ganglion, is always followed by regeneration, but cutting of the root is never followed by regeneration.

(Read before the Pennsylvania State Dental Society, May 4, 1937.)

(From the Neurosurgical Service, Landon Surgical Clinic, The Western Pennsylvania Hospital.)

It is convenient to consider the neuralgias of the face in three groups.

TRIGEMINAL NEURALGIA

Trigeminal neuralgia, or tic douloureux, while not a common disease, is by far the most sharply defined cause of pain in the face, and consequently the most easily diagnosed. Nevertheless, cases still frequently go unrecognized for considerable periods of time, or, when recognized, are treated by measures which are inadequate. Although the clinical syndrome has been known for centuries, the cause of trigeminal neuralgia is still unknown. Its occurrence in older persons is striking, however, and the recent work suggesting its relation to cerebral vascular lesions may be a step in the right direction. Certainly, most cases occur in the sixties, and almost never is it found before the age of thirty. The disease is characterized by repeated brief paroxysms of excruciatingly sharp pain occurring only in the distribution of the trigeminal nerve, aggravated by contact with, or motion of, the face, and which are not controllable by any sedative.

Each of these characteristics deserves brief emphasis, since the diagnosis depends almost entirely on the subjective description of the pain. The pain occurs in attacks having a duration of one-half to three minutes. Between attacks, many patients are symptom free, and most are nearly so, with only a slight residual discomfort. Long remissions (months or years) may occur, but the pain slowly tends to come more frequently, and no case of spontaneous cure has ever been reported.

The pain is variously described as shooting, burning, stabbing or "like electricity," but is always extremely severe. Usually, it tends to recur in approximately the same region each time and the paroxysms are often brought on by movement of the face or by touching it. Ordinary sedatives, even including narcotics, provide little or no relief and none of them stop a paroxysm once it is under way.

There is almost no type of therapy which has not been tried for this affliction: extraction of the teeth, operations on the sinuses, physiotherapy, osteopathy, chiropractic treatments and many varieties of medication have at various times been proclaimed a cure. But the only therapeutic measures known to be effective at present are (1) inhalations of trichlorethylene; (2) alcohol injection of the nerve, and (3) operation to cut the nerve. Each deserves separate consideration.

During the war, a very volatile drug, trichlorethylene, was discovered to have a selective effect on the sensory portion of the fifth nerve. Since that time, it has had a wide-spread use in the treatment of tic douloureux. In our experience, at least, the drug has proved to be a temporary palliative at best, and, in many cases, has been altogether without effect. Many patients, too, find the accompanying sensations of dizziness and fullness in the head so disturbing that they give up the treatment after a few trials. Furthermore, no cases of permanent relief have been reported.

The injection of the peripheral portions of the fifth nerve with alcohol to relieve tic douloureux has been carried out on many different branches and by various technics. In general, the interruption of the maxillary or the mandibular divisions at their point of exit from the skull provides the most complete and effective relief. The advantages of this therapy are obvious: it is rapid, ordinarily requires no hospitalization and entails neither the morbidity nor the mortality of operation. The disadvantages are possibly less apparent: The procedure involves at least a few moments of extremely severe pain; it is not always easy to carry out effectively even in the hands of the most experienced surgeon, and, most important of all, the effects are only temporary. On the average, the first injection

numbs the face and stops the pain for ten to twelve months before regeneration of the nerve is completed and the disease recurs. Subsequent injections become more difficult and less effective, for the increase of scar tissue at the site of injection steadily decreases the penetration of the alcohol. Nevertheless, for the patient who fears operation, for those too old to risk surgery or for those cases in which temporary relief is necessary, the nerve block by alcohol is a very valuable therapeutic measure.

The standard operation for trigeminal neuralgia is section of the sensory root posteriorly to the ganglion, a procedure suggested by Spiller, and first carried out by Frazier, in 1901. This provides permanent relief from the pain, and is the only method now known of achieving this end. It entails hospitalization for about one week and, of course, a certain operative risk. However, the operative mortality in experienced hands is extremely low, about 0.5 per cent, or one death in two hundred operations, even though most of these patients are beyond fifty, and many are over seventy years of age. (Fig. 1.)

Fig. 1.—Patient with bilateral trigeminal neuralgia. The fifth nerve on the right was sectioned in 1932. The same operation was performed on the left in 1937.

As the result of either alcohol injection or operation, some impairment of sensation of the face occurs. The great majority of patients find this change so insignificant after a few days that they are scarcely aware of it. In a few cases, the numbness seems more marked, however, and is accompanied by paresthesia of varying types. But even these are usually regarded as a small price to pay for relief from the agonizing pain of trigeminal neuralgia.

FACIAL NEURALGIA DUE TO TUMORS

1. *Tumors of the Gasserian Ganglion.*—These rare lesions produce a clinical picture very closely simulating that of tic douloureux, and it is only through careful examination of all cases of facial neuralgia that they may be diagnosed preoperatively. Two features distinguish them: 1. Signs of injury to the nerve. These include objective impairment of sensation or subjective numbness in the distribution of the nerve, loss of the corneal reflex and weakness of the muscles of mastication. 2. Signs of injury to nearby cranial nerves, particularly the third, with pupillary changes or ptosis; or to the sixth, with

Fig. 2.—Patient suspected of tumor of left gasserian ganglion. The area of diminished sensation of the left cheek and deviation of the jaw to the left are the result of weakness of muscles of mastication.

weakness of external rotation of the eye. Their treatment is, of course, operation and the extirpation of the lesion. (Fig. 2.)

2. *Brain Tumors.*—Occasionally, cerebral tumors, particularly those involving the base of the temporal lobe or the cerebellopontine angle, may press on the fifth nerve early and simulate tic douloureux. Again, the correct diagnosis is largely dependent on careful neurologic examination.

3. *Malignancy of the Face, Mouth or Sinuses.*—The pain suffered by these patients is usually of a totally different character from that of trigeminal neuralgia. Usually, too, the lesion is apparent on even casual examination. They are

Fig. 3.—Patient with metastastic malignancy involving right gasserian ganglion, after operation for relief of pain.

mentioned here partly for the sake of completeness, and partly because alcohol injection or the section of the root of the gasserian ganglion is not infrequently carried out in cases of inoperable malignancy of the face to relieve needless suffering and to permit more drastic therapeutic attacks by irradiation or surgery. (Fig. 3.)

ATYPICAL NEURALGIA

The term atypical neuralgia is commonly used to describe the pain of a miscellaneous group of patients whose facial discomfort is not the result of trigeminal neuralgia, nor is it related to obvious dental disease or due to any apparent malignancy. These cases present extremely difficult problems from the standpoints of diagnosis and treatment.

The pain of atypical neuralgia contrasts sharply with that of tic douloureux. It is usually described as dull, aching, drawing, pulling, throbbing or, sometimes, burning. It is more or less constant, but not extremely severe, and occasionally the apparent comfort of the patient at a time when his pain is supposedly almost unbearable is striking. The pain varies greatly in the same patient from time to time, in intensity, character and location. It is rarely confined to the distribution of the fifth cranial nerve, more often spreading to the occipital region, down the neck or even into the shoulder. Furthermore, the patient usually describes his discomfort as deep "in the bone"; in contrast to the more superficially felt tic douloureux "in the cheek" or "in the gum." Finally, contact and motion do not aggravate atypical neuralgia, and mild sedatives may relieve it.

The problem of treatment in these cases depends largely on the etiology of the pain. This varies so widely that each case is in reality a problem in itself which must be dealt with individually and without too strict adherence to any set procedures. Nevertheless, a few general principles may be presented before discussing briefly some of the various etiologic factors and their treatment. 1. The patient will often appreciate at the outset a frank statement explaining in some measure the difficulties of diagnosis and treatment, and the need for a reasonable degree of patience while various diagnostic and therapeutic measures are carried out. 2. The regular use of mild sedatives will often permit a patient with atypical neuralgia to carry on with comfort while a

search for more specific therapy is made.

3. All operative procedures, including nerve injections, sinus operations and extractions of teeth, should be avoided as far as possible, and carried out only after thorough study has ruled out other causes of the pain and disclosed very definite indications for surgery.

Some of the more common types of atypical facial neuralgia will be discussed briefly.

1. The pain may be due to obscure infection or tumor about the face. It is obvious that careful search for abscessed teeth, sinus infection or early sinus or mouth malignancy is of primary importance in these cases, and will even bear frequent repeating if the pain continues over a considerable period. In at least two cases, I have seen atypical neuralgia supposedly based on a psychoneurosis prove to be due to sinus neoplasm after several years of repeated examination and varied therapy.

2. Certain cases show clear-cut evidence of disturbance of the autonomic nervous system: pupillary changes or ptosis, vasomotor instability, sweating or unilateral lacrimation. While knowledge of this portion of the nervous system is still limited, it is known that these patients frequently may be relieved by the use of drugs that affect the sympathetics or para-sympathetics: atropine, acetylcholine preparations and histamine; or occasionally by the interruption of parasympathetic fibers by paravertebral injection or by cervicothoracic sympathectomy.

3. Occasionally, an atypical neuralgia may show characteristics of migraine, a tendency to periodic attacks, accompanying gastro-intestinal or visual disturbances, a family history of similar pains, etc. Here, ergotamine tartrate preparations are frequently effective.

4. Endocrine disturbances of the pituitary or parathyroid, for example, may occasionally be important.

5. Cerebral vascular changes may sometimes be responsible.

6. Allergic factors may play a part in certain cases.

7. Last, but by no means least, are those cases in which the pain is found to be related to some psychic difficulty, some source of conflict or maladjustment. Where the psychiatric problem is a difficult one, treatment by a psychiatrist is of course preferable, but occasionally the more simple and more obvious sources of underlying mental strain may be detected and remedied without extensive psychiatric study or therapy.

SUMMARY

Trigeminal neuralgia is characterized by paroxysmal attacks of excruciating facial pain, aggravated by contact or motion and not relieved by any ordinary medication. This severe pain may be relieved for a period of months by injection of alcohol into the peripheral branches, or permanently by the cutting of the sensory root of the nerve.

Occasionally, facial pain occurs as an early symptom of brain tumor, tumor of the gasserian ganglion or tumor involving the sinuses. Every effort should be made to diagnose such cases correctly at an early stage and to remove the tumor. If this is impossible, injection of the trigeminal nerve or section of its sensory root will save the patient much needless suffering.

Atypical neuralgia, which is characterized by prolonged variable pain in the face and neck, is best attacked by the search for, and removal of, the underlying cause. In such cases, the extraction of teeth, operation on the sinuses and operation on the fifth nerve should be avoided, unless clearly indicated.

INFLUENCE OF DIET ON THE JAWS AND FACE OF THE AMERICAN ESKIMO

By L. M. Waugh, D.D.S., F.A.C.D., New York City

IN 1887, J. Howard Mummery, of Birmingham, England, published the results of a series of dental examinations he had made of peoples living under distinctly varying conditions in different parts of the world. About this time, W. D. Miller, then resident in Berlin, Germany, was carrying on laboratory investigations to determine the cause of dental caries. The two men were primarily interested in the same problem, the former hoping to find the answer from clinical data; the latter, by laboratory investigation. Both accomplished much.

Miller astonished the dental profession and the scientific world by proving that the exciting cause of tooth decay is a bacterial process in which acid-forming organisms colonize on the surface of the enamel.

Mummery proved that certain races suffer much less from dental caries than others and pointed out that the class of food intake has an important bearing on the condition. He found that meat-eating tribes have a strikingly lower percentage of tooth decay than those having a mixed diet. He instanced two related tribes in South America living on the two sides of the Andes Mountains. Those residing to the eastward in the Argentine Republic, being a cattle-breeding, meat-eating tribe, showed about 19 per cent tooth decay, whereas their relatives living on the west side in Chile, being farmers who raised mixed crops and therefore consumed a mixed diet, showed about 38 to 40 per cent. He examined the teeth of other tribes, among them the Eskimos of Greenland, whom he reported as having only about 2.40 per cent, and reported also that though a people of small stature, they have notably large jaws and regular teeth. As an undergraduate dental student, I was deeply interested in these reports.

About 1908, the then Institute of Dental Pedagogics met in Washington, D. C., and was addressed by Ales Hrdlička, curator of physical anthropology at the Smithsonian Institution, on mouth conditions of the races of mankind. His statements corroborated Mummery regarding the Eskimo and were borne out by the extensive collection of Eskimo skulls in the museum. This collection, I eagerly studied with his assistance, using the information gained in a course in special pathology for the dental students. It had become my ambition to visit the Eskimo to see first-hand in the living specimen the caries-free mouths, the massive jaws and the strong, regularly alined teeth which combine to produce such outstanding examples of normal, efficient occlusion.

In 1921, my plans for a longer summer vacation permitted me to go to Labrador. Eagerly, I looked forward to the opportunity of examining the mouths of the Eskimo. After weeks of travel, we reached Makkovik, the southernmost settlement of the Eskimos, and a week later Hopedale, the largest settlement on the Labrador coast. We were welcomed by kindly Moravian missionaries, who gave us every possible assistance in our study. To

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my utter astonishment, however, I found, instead of the best dental conditions, probably the worst I had ever seen. My first examinations were of the children and younger adults, all of whom had suffered much from tooth disturbances. The question immediately arose in my mind as to why the conditions here were so extremely different from those reported by Mummery and corroborated by Hrdlička. The quest for information that would explain the contradictory conditions that I found in these missionary settlements of the Eskimo has taken me to Labrador for four summers; the last, around the farthest north headland into Hudson Straits and Ungava Bay. In Labrador, I had the opportunity to study about 800 Eskimos, this being the number on that coast. Being desirous of completing a study of the American Eskimo and learning that there are about 18,000 Eskimo natives in Alaska, we have gone afield there for two summers and have, so far, visited the thirty-two most important settlements in North Bering Sea and Arctic Alaska from the Yukon River to the farthest north settlement on the American continent, and, during the past two summers, the Kuskokwim-Hooper Bay district, which is the most primitive and populous on the continent.

The studies in Labrador were made under the auspices of Columbia University and were reported to the International Association for Dental Research. Abstracts were published in the *Journal of Dental Research*.[1] The study in Arctic Alaska was made under the auspices of the United States Public Health Service with the approval of Columbia University and the generous assistance of the United States Coast Guard. Abstracts of these reports also may be found in the *Journal of Dental Research*.[2]

In my previous reports of the study, the question of dental caries was primarily dealt with. In this report, I shall endeavor to interpret the study from the point of view of the growth and development of the jaws and face, this subject being of special interest to the orthodontist. To facilitate the gathering of data, the following questionnaire was prepared:

QUESTIONNAIRE RELATING TO ALASKAN NATIVES

For Dr. Waugh, dental surgeon, U.S.P.H.S. (R) detailed to the Cutter Northland, for a cruise in Alaskan waters to Barrow in 1929 and in 1930:

Name of settlement ..... Race .....
Health ..... General condition ..... Population .....
Illnesses ..... Most common .....
Epidemics ..... Most common ..... Dates .....
Endemic diseases (infections) .....
Dwellings ..... Types of .....
Sanitary precautions .....
Bathing habits .....
What care is given new born infants? .....
What kinds of clothing are worn? .....

MORTALITY

How many of the natives have: (a) Tuberculosis (Pulmonalis)? .....
(Closed cases)? .....
(b) Syphilis (Acute)? .....
(Chronic)? .....
(c) Gonorrhea (Acute)? .....
(Chronic)? .....
What are the sources? .....
What sequelae are observable? .....

Do you feel that they are important contributing causes in lowering the life expectancy? .....
What opportunities for: School training? .....
Vocational training? .....
Church training? .....

Kindly check the foods used in your territory:

Fats	*Protein or nitrogenous*	*Carbohydrates*
Seal blubber or oil	Red meats of reindeer	Sugars
Whale blubber	Caribou	Molasses
Walrus fat	Walrus	Candy
Cod oil	Whale	Potato
Salt pork	Baluga	White Flour
Cow butter	Seal	Oatmeal
Margarine	Bear	White cereals
Name any other fat or oil	Trapped animals and	Cornmeal
	Fish (kinds)	Rice
	Birds (kinds)	Beans
	Eggs (wild)	
	Cow milk (tinned)	
	Goat milk	

Give estimate of total percentage of (a) fats.....; (b) proteins.....
(c) carbohydrates consumed.....taking all food eaten as 100 per cent.

VEGETABLES

Are wild vegetables eaten, such as buds, grasses, etc?.....Cooked or raw.....
If so, in what quantity? Name or describe them.....
Do they have gardens?.....
Do they buy tinned vegetables?.....
If so, what kinds and how much per person per year?.....
Give any other information regarding food.....

TEETH

Do they suffer much from tooth troubles?.....
How do they overcome them?.....
Are the teeth of the older generations decidedly better than those of the younger?.....
To what do you attribute this?.....
Do they ever clean their teeth?.....If so, how?.....
Add anything bearing on this subject.....

Please be sure to fill in the following:
Your name.....
Alaska address.....
Home address.....
Are you serving as: (a) Physician.....(b) Nurse.....(c) Govt. teacher.....
(d) Missionary.....(e) Social worker.....(f) Trader.....(g) Prospector.....
How many years have you worked in this capacity in Alaska?.....
I should like to quote you in my official report, but shall not do so without your consent.
May I use your name?.....

Mail to: Dr. L. M. Waugh
576 Fifth Avenue,
New York, N. Y.

(Signature) .....

From this study, the statements of Mummery and Hrdlička were found to be true of the Eskimo, both in Labrador and in Alaska, as long as he lived the primitive nomadic life of his ancestors. However, when he adopts the white man's diet and mode of living, there is marked deterioration in the size and strength of the jaws, and in the regularity of the teeth. This occurs in startling degree and is observable even in one generation. The change in food and use of the teeth is the determining factor.

When subsisting as his ancestors did, the Eskimo ate proteins and fats almost exclusively, these varying between 35 and 65 per cent at different seasons of the year. The proteins included the red meats of seal, walrus, sea lion, whale, baluga, caribou, reindeer, bear, trapped animals, birds and fish of various kinds. These were hung in the sun to "cure," and, because of the purity of the air and the prevailing temperatures in the summer (average for June, July and August, 40 to 50 F.), they became dry and hard and

Fig. 1.—Eskimo family, Deering, Alaska, reared on native foods. The jaws are large and strong.

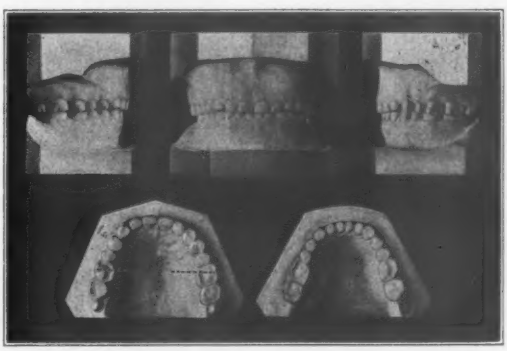

Fig. 2.—Well-worn teeth with no decay. (Model made from teeth of man shown in Figure 1.)

required much vigorous chewing. In the winter, they were frozen solid; and because a seal-oil "lamp" was the only means of providing heat for cooking, which was slow and inadequate, this meat were generally dipped into seal oil as they were eaten. Fats formed the remainder of the diet, sometimes as much as 65 per cent.

This vigorous chewing of food is be-

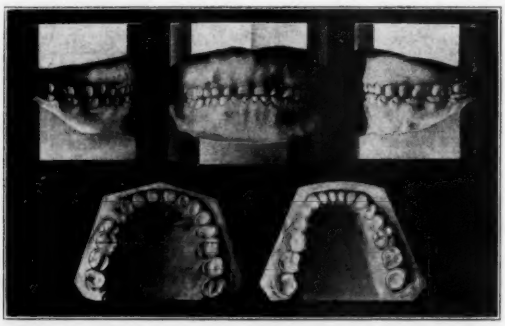

Fig. 3.—Thirty-two well-worn teeth with no decay. The jaws are wider than those shown in Figure 2. (Models made from teeth of woman shown in Figure 1.)

Fig. 4.—Temporal masseter muscles flexed; strong development over ramus due to vigorous chewing.

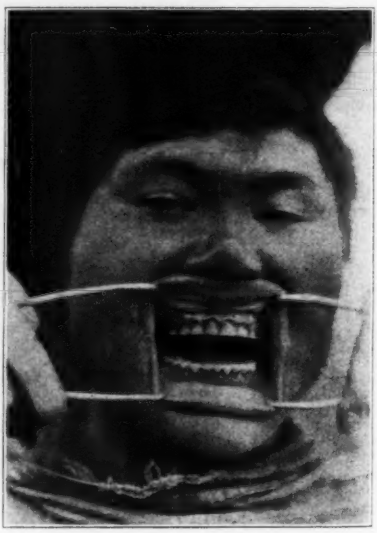

Fig. 5.—Strong jaws and regular, undecayed teeth of primitive Eskimo.

frozen food was eaten without preparation beyond putting it in the igloo for a short time to partially thaw. Fish and yond question the great factor in jaw development, as the children have little other food after weaning. Newly erupted

teeth have cusps, grooves and fossae as deep and well formed as those of white children; but, because of the vigorous mastication, the occlusal surfaces soon become so much worn that, by twelve to sixteen years of age, they are quite noticeably flattened. This is probably due in part to the presence of grit, picked up when the fresh meat and fish are laid on the ground prior to "curing." As the occlusal surfaces of the teeth become abraded, still greater muscular effort is necessary for mastication.

All this undoubtedly promotes growth of the jaws and enlarges the face. Not only do the dental arches assume a larger regular outline, sometimes with a strong tendency to assume the inverted letter u form, but the body of the jaws and the alveolar processes are very thick and strong. The degree to which this enlarging of the arches occurs should be of special interest to the orthodontist in his effort to stimulate bone growth without appliances on the sound physiologic principle that "the use of an organ determines its strength," that "function begets structure" and that bone is under the domi-

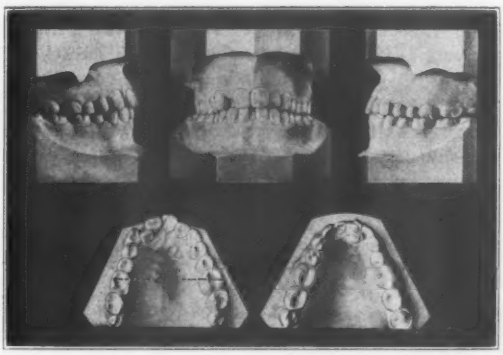

Fig. 6.—Crowded teeth in one generation, the condition resulting from the use of soft, non-resistant foods during childhood.

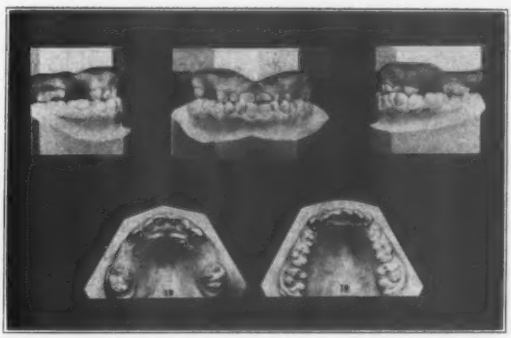

Fig. 7.—Casts of teeth of Eskimo child, aged six years, showing premature loss of deciduous teeth resulting from eating candy and other sweets, and prédisposing the child to malocclusion of the permanent teeth.

nance of actuating muscles. Exercises properly selected and persistently performed by the patient must, therefore, when indicated during treatment, be helpful in the stimulation of jaw growth.

The pioneer work of Alfred E. Rogers in this field must be here credited. His generous writings and motion photography of the various exercises have been most helpful in their application to orthodontic treatment, and practitioners who do not now prescribe these exercises are urged to do so. The very apt term "myofunctional therapy" recently suggested by B. E. Lischer should be adopted.

The Eskimo also exercises the teeth and jaws in softening the raw, dry hides from which muk-luks, native boots, clothing,

Fig. 8.—Salmon curing in air and sun without salt or smoke.

harness, etc., are made and in resoftening dried, hardened, raw sealskin boots. It is the rule that at fourteen years or over, the teeth are much worn, at twenty to thirty-five often to half the length of the crowns; and beyond thirty-five, they are very frequently worn almost to the gum. This is more noticeable in women who "make" the boots, clothing, harness, etc., and probably explains why the jaws of the female are often larger than those of the male.

In natives aged 35 or older, a prominent bulging ridge is frequently noticeable on the buccal surfaces of the alveolar process over the cervical half of the root of the upper teeth, and a more prominent one, about one-fourth inch wide, on the lingual side of the lower teeth along the apical half of the roots. This we regard as adventitious alveolar process, due to excessive and persistent chewing, especially after the occlusal surfaces are worn comparatively flat. This full, almost bulging alveolar process is suggestive of that seen in some of the lower animals.

In marked contrast to the foregoing is the lack of this thick, strong growth in the jaws of natives who get so-called "white man's food" from prospectors, miners and traders and at stores. The Eskimo, especially the young, prefer sweet, soft food that requires little chewing; and, when thus fed, the children of rugged-jawed parents have very noticeably smaller and less strongly formed jaws. Under these conditions, which are unnatural for them, irregularity of the teeth becomes extreme, as in American white children, and usually occurs in from one to two generations.

The striking suddenness with which this deterioration occurs may possibly be explained by a consideration of the alveolar process. This bony support for the teeth is a transitory structure. It is built coincidently with the formation of the roots and the eruption of the teeth. It forms wherever a tooth erupts, be that in the dental arch, palate or nasal cavity, etc. The alveolar process for the deciduous tooth is formed on eruption of the tooth and is resorbed as the tooth is shed. If the eruption of the permanent successor is considerably delayed, practically all of the alveolar bone supporting the deciduous tooth disappears and an entirely new alveolus is grown for the erupting permanent successor. If the permanent tooth follows closely the loss of the deciduous predecessor, its supporting alveolus is probably built into that for the permanent tooth. Because of this, we feel that a definite functional distinction should be given the alveolar process, even

though its minute structure is microscopically demonstrable as being continuous.

From this study of the Eskimo dentition, we have come to believe that the size of the body of the jaw is determined largely by heredity, and the form, quality and size of the alveolar process is primarily the result of function. As it is the alveolar process in which the orthodontist brings about the greatest changes during treatment, the foregoing interpretation, if correct, must be of utmost importance in etiology, diagnosis, classification and treatment of malocclusion.

Data for this survey have been collected during the past fifteen years under the joint sponsorship and assistance of Columbia University, the United States Public Health Service, Treasury Department, United States Office of Indian Affairs, Department of the Interior and of the United States Coast Guard.

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POINTS OF CONTACT BETWEEN DENTISTRY AND NEUROLOGY

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I HAVE been invited to speak on a subject which is important but seldom discussed, the mutual relationships between dentistry and neurology. It might appear, on first thought, that these two branches of medical science have indeed few points of contact, but I am convinced to the contrary. It is indeed a truism that no two branches of biologic science are dissociated, that all biology is a unit and that our conventional divisions of it are artificial. As far as the fields of dentistry and neurology are concerned, they should be especially close, since both the nervous system and the teeth are of ectodermal origin, and present certain parallels in their embryologic development. At any rate, I am convinced that every neurologist should know more dentistry, and that the average dentist would profit in many ways if he had more information about neurology.

We are all familiar with the fact that among the so-called stigmata of degeneracy which so often accompany mental defects are developmental abnormalities of the teeth. Scarcely anything in nature is perfect, but extreme degrees of dental dysplasia—malocclusion, poor alinement and improper spatial relationship of the teeth, disharmony between the teeth and the mouth, as well as poor dental nutrition—are all apt to be found in mentally defective persons. Mention should be made of congenital syphilis, so often the cause of dementia, and Hutchinson's teeth, with which you are all familiar, those upper central incisors of the second set, with the peg-shape, and the curved notch on the biting edge, which frequently penetrates the enamel and exposes the underlying dentin. This notch represents a

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large arc of a small circle, rather than a small arc of a large circle. One can easily distinguish Hutchinson's teeth from so-called pitted teeth, in which the enamel on the face of the tooth is penetrated by small holes, and which represent a nutritional defect. In association with Hutchinson's teeth are other evidences of congenital syphilis, such as mental defect, clouding of the cornea of the eye (interstitial keratitis), pupillary inequalities and irregularities and deafness. Needless to say a dentist, seeing such teeth in a child, should suggest consultation with a good physician.

NEUROLOGIC CONDITIONS APPEARING TO HAVE DENTAL MANIFESTATIONS

In discussing the relationships between dentistry and neurology, I wish first to emphasize the fact that certain neurologic conditions may manifest themselves primarily in the dental field and thus simulate dental disease. They thus may become important diagnostic problems for the dentist.

The teeth, receiving their innervation from the fifth cranial, or trigeminal, nerve, are often the seat of pain when disease attacks that nerve. It is human nature for a patient with pain in a tooth to attribute his suffering to disease in that tooth. The dentist likewise, unless he can distinguish pain caused by an affection of the nerve, will blame the tooth, and may be persuaded to extract it. Now there are several neurologic conditions which may lead to this mistake, some of which are more common than others. In the following account, I shall discuss the most important of these and attempt to point out their distinguishing characteristics. Attention to a few diagnostic criteria will save the teeth of many patients, as well as serve to protect the dentist's reputation in the eyes of his patient.

Trigeminal Neuralgia. — Trigeminal neuralgia is unquestionably the most frequent neurologic cause of pain in the jaws and the teeth. So often does this form of facial pain lead to extraction of teeth that the neurologist, unless he sees the patient in his very first attack, expects to find that at least some have been removed and even questions the diagnosis if they have not. That an edentulous condition is considered one of the most constant findings in trigeminal neuralgia should not be regarded as a reflection on the dentist, since these unfortunate patients are so firmly convinced that the teeth are to blame that they go from one dentist to another and insist on extraction until someone eventually obliges them. Perhaps as often as not it is the fault of the physician who asks the dentist to extract the "offending" teeth. After his precious molars are gone, never to be replaced, the patient discovers that his pain is unmitigated, and that he must seek elsewhere for relief.

Trigeminal neuralgia, a disease of middle life and old age, common to both sexes, is so stereotyped and constant in its manifestations as to be unmistakable. In medicine, we hear the aphorism that "if it cannot be confidently diagnosed over the telephone, it is not trigeminal neuralgia." The pains occur in paroxysms or attacks lasting usually weeks, but even months, with periods of freedom between. During the attacks, however, the pains are not constant, but occur in paroxysmal, lightning-like flashes, which last at most only a few seconds, but are repeated with an exasperating monotony. These flashes of pain are almost invariably unilateral. They vary in severity, but not in distribution, and they may arise apparently spontaneously or, more often, on stimulation of a "trigger zone," a sharply localized spot on the cheek or in the mouth or throat. Frequently, such activities as talking, chewing or swallowing serve to precipitate attacks, while the lightest touch or even a breath of wind may suffice to bring them on.

This truly formidable disease is of unknown etiology. It is often recommended that the foci of infection be removed, but

it cannot be maintained that this ever helps very much, nor can such a theory excuse the removal of vital and apparently sound teeth. The proper treatment of the condition consists of injection of the trigeminal nerve or of its branches with alcohol, or section of the root of the nerve surgically. From the dentist's standpoint, the important feature is the differentiation of trigeminal pain from the pain of dental disease. In making this differentiation, emphasis should be laid on the sudden, paroxysmal nature of the pain in the trigeminal neuralgia, its short duration and sudden cessation and its reappearance on stimulation of the so-called trigger zone. The physician or the dentist who will remember these characteristics will save many teeth for his patients.

Glossopharyngeal Neuralgia.—This is another form of pain in or near the face which may be confused with pain of dental origin. Not so well known as trigeminal neuralgia, nor so common, it is remarkably similar to the latter affection, and has been differentiated from it only in the past fifteen years, after the work of Sicard and Robineau, about 1920.[1] It simulates trigeminal neuralgia in the manner of its occurrence, its paroxysmal onset, its brief duration and its tendency to frequent repetition in attacks lasting for hours or days, and in the characteristically lancinating and piercing type of pain. It is similarly provoked by stimulation of the so-called "trigger-zone," which is most often deep in the throat and is irritated by swallowing. Its area of distribution is, however, different from that of trigeminal neuralgia. The pain occurs in the area supplied by the glossopharyngeal nerve: the tonsillar area, the soft palate, the posterior and lateral aspect of the pharynx and the tympanum of the ear. The base of the tongue is also frequently the seat of the pain, which may radiate down into the neck. The pain, like that of trigeminal neuralgia, is nearly always unilateral.

It will be noted that these areas do not include the teeth, but, in many patients, the ability to localize pain is poorly developed, especially when the pain is exceedingly sharp and piercing. As a consequence, the disturbance may seem in some people to include the posterior molar teeth on the involved side, and the notorious tendency of the average person to attempt to make his own diagnosis may lead the patient to complain of toothache and request his dentist to extract the supposedly offending teeth. The careful dentist will, however, question the patient closely and refuse to remove the teeth when he is informed of the characteristic repetitive, lancinating pain with its unique localization and its tendency to radiate to the ear of the same side. Such a patient should, instead, be referred to a neurologist for treatment or management.

The glossopharyngeal nerve cannot be injected with alcohol, since it lies too deep. The correct procedure involves the operative section of the nerve. Skepticism and conscientious investigation of the patient's symptoms by the dentist will thus save innocent teeth in these cases.

Sphenopalatine Neuralgia.—This condition is also rare as compared with trigeminal neuralgia, but, in a few cases, may likewise serve to lead the unwary dentist to perform unwarranted extractions. This type of pain was first described by Dr. Sluder, of St. Louis, as early as 1908,[2] and the syndrome sometimes bears his name. This form of neuralgia arises, it is believed, from a disturbance of the sphenopalatine ganglion, and a brief discussion of the anatomy and connections of this structure will serve to explain the symptoms.

This ganglion, which is part of the autonomic or sympathetic nervous system, is situated in the upper part of the sphenomaxillary fossa. It receives fibers through the *nervus intermedius* of Wrisberg and the superficial petrosal nerve, and also from the stellate ganglion of the sympathetic trunk. It gives off fibers to the blood vessels and glands of the orbit, roof of the

mouth, palate, tonsils, nose, septum and the upper incisor teeth. These nerves exert a vasoconstrictor and vasodilator effect in these areas, and stimulate the lacrimal glands and the mucous glands of the nose.

Sphenopalatine neuralgia is a highly characteristic syndrome. The term has often been abused by the medical profession, and stretched to include far too many non-specific types of pain. The clinical manifestations embrace two main symptoms, of which the first is pain. This is a steady, persistent headache, which usually arises around or in the eye and radiates to the temple and behind the ear, passing sometimes down into the neck, or even to the occiput or scapula. The pain, unlike that in other forms of neuralgia, is not lancinating or stabbing, but rather persistent, boring or throbbing. The upper incisors may ache, and often the patients complain that these teeth feel too long. In this respect, the syndrome may lead the sufferer to suppose that the teeth are responsible, and to seek the aid of his dentist. The other main symptom results from the secretory functions of the sphenopalatine ganglion, consisting of profuse lacrimation and nasal secretion of mucus during the period of pain. It is this tendency to secretion which largely characterizes the syndrome, and which should warn the dentist, as well as the physician, that the teeth are not responsible. This unique combination of bizarre headache, pain in the teeth, a sensation of increased length of the central incisors and profuse nasal secretion and lacrimation should be easy to recognize, and should lead the dentist to refuse to extract teeth which are really innocent.

The proper treatment of sphenopalatine neuralgia consists of confirming the diagnosis by cocainization of the ganglion and thus temporarily stopping the pain, and later injecting the ganglion with alcohol and thus achieving permanent relief. These procedures can be carried out by a skilled rhinologist, who makes his approach through the nose. In some cases, relief may be obtained by painting the ganglion with silver nitrate or actually avulsing it surgically.

Syphilis of the Central Nervous System.—This condition occasionally produces pain in the face, although the complication is very rare. It is impractical to discuss the broad question of neurosyphilis here, but it may be stated that involvement of the nervous system occurs quite late, and usually five or more years after the primary infection. Of the several types of neurologic syphilis, tabes dorsalis is the one most likely to give rise to pain. In this type of the disease, so-called lightning pains frequently occur in the lower extremities. Still more rarely, such pains may occur in the face. I have seen one or two such cases.

Lightning pains of tabes dorsalis resemble very closely the pain of trigeminal neuralgia. They are paroxysmal, lancinating, piercing or cutting. They recur repeatedly in the same place, and may leave the skin very tender to gentle touch, but usually not to pressure. These pains result from chronic syphilitic granulation tissue involving the sensory roots, and such an explanation is valid in the case of the fifth cranial, or trigeminal, nerve. Pains of this type may likewise appear to arise in the teeth, and may cause the patient to seek dental care. The differentiation from pain of dental origin is much the same as in the case of trigeminal neuralgia. In the case of tabes dorsalis, however, the pain has usually existed in other locations and is often associated with tenderness of the skin to light touch. Frequently, irregular areas showing slight impairment of pain sensibility may be discovered in the face in such cases; but, for this examination, the dentist will probably need neurologic assistance, because of the mildness of the sensory loss. In addition, of course, there should be no evidence, in these cases, of disease in the suspected tooth. The dentist, under these circumstances, will wish to enlist the diag-

nostic aid of a physician or neurologist, in order to avoid unnecessary treatment or extraction of an innocent tooth.

An interesting dental observation which can sometimes be made in cases of tabes dorsalis concerns the reduction of the sensibility of the teeth to vibration. In all cases of this disease, pain and vibration sense is reduced or lost in the lower extremities. In some, this sense is likewise impaired in the teeth. Theoretically, this should make tabetic patients very tolerant of the dentist's drill, and Pentz and Borman[3] have actually demonstrated insensitivity of the pulp of the teeth in cases of syphilis of the nervous system.

Other Diseases of the Trigeminal Nerve.—There are other conditions of the trigeminal nerve that may occasionally lead to confusion with dental conditions. These are rare and may be difficult to diagnose. They will in any case trouble the dentist very seldom. Tumors of the gasserian ganglion are extremely rare, but, when present, may produce severe pain in the face or teeth. In such cases, however, anesthesia of the face occurs, tending to extend gradually to involve the whole area of distribution of the trigeminal nerve. The motor functions of the nerve are likewise impaired, with weakness of the muscles of mastication on the homolateral side. One result of this will be the tendency of the mandible to deviate toward the weak side when the mouth is opened. Neuritis of the trigeminal nerve practically never occurs and need scarcely be considered.

Before leaving the subject of neurologic conditions which may give the dentist concern, something should be said about the gingivitis which results from overmedication with the heavy metals. This condition is, of course, familiar to every dentist, and only one or two points need be emphasized here. The metals responsible are those used in the treatment of syphilis, and the classic example, of course, is mercury. This metal is still important in neurologic therapeusis; but, during the past fifteen or twenty years, another metal, bismuth, has come to be even more widely used against syphilis than is mercury. It is not always realized that bismuth has a tendency to produce much the same type of gingivitis, pyorrhea and bluish gray line on the gum as that caused by mercury. Lead intoxication causes almost the same condition, and possibly other metals would do the same. One should remember that bluish stains occur in ordinary pyorrhea at times, but that the blue line of intoxication by heavy metals is in the gum itself, and can be seen especially well when a piece of white paper is slipped between the tooth and the gum. Preexisting pyorrhea and generally poor oral hygiene predispose to metallic gingivitis, and it therefore follows that careful attention to the mouth and teeth should be observed during medication with mercury and bismuth. Through cooperation between the physician and dentist in such cases, antisyphilitic measures can be more satisfactorily carried out and thus a great service be rendered the patient.

Up to this point, attention has been directed to those neurologic disturbances which may simulate dental diseases, and thus come within the purview of the dentist. There are, however, two sides to the relationship between these two biologic sciences, and I should like to consider several respects in which dental conditions and procedures may affect the nervous system.

DENTAL SEPSIS AS FOCAL INFECTION

The doctrine of focal infection has held sway for many years, particularly in America, and the best work in support of the doctrine has come from this side of the Atlantic. The popularity of the theory knew but few bounds for many years, but a note of conservatism characterizes the modern attitude on the subject. There seems to be little doubt that focal infection plays a much less important rôle in physical disease than was once believed.

Certain forms of arthritis are probably due to complicated metabolic disturbances rather than to infection, and many other conditions have likewise been removed from the class of infectious diseases. There remains, however, a large group which seems unquestionably to be due to bacteria, borne by the blood stream from foci of infection to various parts of the body. In this group, there are some neurologic diseases, and it is my purpose to mention at least some of these. In almost all of them, a certain degree of doubt persists, and a few may eventually be shown to be independent of foci of infection.

It is difficult to say in any given case whether it is the teeth which harbor the infection. The tonsils, sinuses and other sites may in any case be responsible, and it is usually only by elimination that the matter can finally be settled. This throws a serious responsibility on the physician and dentist, who must find and remove the offending infection, at the same time avoiding the sacrifice of innocent teeth.

What are some of the signs which should guide us? I hope I shall be pardoned for my presumption in discussing before a body of dentists the criteria for the recognition of teeth which harbor focal infection. My excuse is that although all dentists know what I am about to say, they do not all act on their knowledge. The dentist has a unique point of view in this matter, and one which differs widely from that of the physician. He is concerned primarily with the problem of saving teeth for the patient. His entire attitude is apt to be one of conservation, and in his attempt to conserve teeth, he is liable to fail to see the broad problem of the total welfare of the patient. A tooth which may be structurally and mechanically efficient may harbor a threat to other organs of the body, and the prime consideration should not be "What can I do to preserve this tooth?" but rather "Will preserving this tooth endanger the patient?" A Biblical epigram may thus be paraphrased to read, "If thy tooth offend thee, pluck it out," although the tooth be still capable of giving acceptable service.

In the matter of focal infection, pyorrhea is usually not important. Such infection is more often open and draining, and although septic material may be swallowed, it is usually sterilized in the stomach. It is rather apical infections which spread into the blood, since they have no open outlet. Such apical infections nearly always exist in devitalized teeth, or in those which have undergone pulp degeneration. Such non-vital teeth may indeed be innocent, but they are in any case potential threats. They do not cause pain, and consequently do not warn the patient of their danger. It is often possible to look at a tooth and tell whether it is still vital, but no man lives who can look at a tooth and tell whether it harbors apical infection. The roentgen rays must be relied on to answer this question, and I believe all dentists recognize the truth and importance of this fact.

Neurologic diseases which may arise from dental foci may be mentioned without detailed discussion. All forms of infectious neuritis, including optic neuritis, probably should head the list. In the presence of a "silent" (that is, not yet pathogenic) focus of infection, it is probable that exposure, chilling of the body or other conditions which reduce the general resistance of the patient may precipitate some form of neuritis. Chorea, or St. Vitus' dance, is more often due to infections arising in the tonsils, but the teeth may, on occasion, be responsible. Encephalitis may possibly arise from dental infection, although this matter is certainly in doubt. About multiple sclerosis, infectious myelitis and other infections of the nervous system, we can be even less sure. To sum up: In any chronic infectious disease of the nervous system, all devitalized teeth should be removed, even though actual apical disease may not be demonstrable. In the case of acute neurologic infections,

such as chorea, the teeth suspected should not be removed until the acute disease has subsided.

NITROUS OXIDE ANESTHESIA AND THE NERVOUS SYSTEM

For many years, nitrous oxide has been considered the safest of all quick-acting general anesthetics, and it probably now is. Because of its relative harmlessness, as well as its prompt and brief action, it has been a favorite among dentists when a general anesthetic was to be used. With the perfection of the technic and the efficiency of local anesthesia for dental work, the use of gas and other general anesthetics has declined almost to the vanishing point. This preference for local anesthesia has also manifested itself in general surgery, until today many operative procedures which in former years were carried out with general anesthesia are done with procaine and similar agents. Even brain surgeons use these local methods almost exclusively, and this statement applies to many other surgical fields. However, in certain instances, general anesthesia is preferable, especially in the case of children and other persons whose nervousness or lack of self-control complicates the situation.

For brief periods of time, such as those required for most dental work, nitrous oxide is indeed an ideal agent, but prolonged anesthesia with gas may in certain cases be dangerous. I mention this fact, because the hazard from the use of nitrous oxide, as with carbon dioxide, has largely to do with the nervous system. Recent studies by Courville[4] and others have shown that, in certain patients, death or serious neurologic injury may result from nitrous oxide anesthesia. The damage in such cases results from the fact that nitrous oxide and carbon dioxide require a state of rather deep asphyxia before they produce anesthesia. Now asphyxia and anoxemia produce serious brain damage when prolonged, and especially in persons whose cerebral circulation is already impaired, as by congenital or acquired heart disease or any chronic lung disease. In such cases, the supply of oxygen to the sensitive cerebral centers is inadequate, and the patient may suffer death or serious and permanent damage. A considerable number of cases are now on record in which various degrees of paralysis and disability have resulted from such damage, and although they are rare, they are sufficiently common to warrant extreme caution in the use of nitrous oxide or carbon dioxide.

The application to the practice of dentistry is obvious. Every dentist should be aware of the danger and keep in mind the types of patient in whom the hazard is greatest. To specify: Nitrous oxide should not be used in elderly patients, or in any patient in whom there is any reason to believe cardiac or pulmonary disease or inadequacy exists. Since the dentist is not often in a position to discover such cardiac or pulmonary diseases himself, he should, in all cases, inquire of the patient or the patient's physician regarding these matters before administering gas. He should refuse to use gas at all where the slightest doubt exists. Finally, he should be ready, when administering nitrous oxide, to shift to 70 per cent or 80 per cent oxygen at the first evidence of distress on the part of the patient, and to administer epinephrine by hypodermic. If he will decline to use gas wherever possible, and rigidly observe these qualifications and precautions whenever he does use it, unfortunate results will be largely avoided.

PSYCHOLOGIC IMPLICATIONS OF DENTISTRY

There are innumerable ways in which the teeth are psychologically important. Dentists can undoubtedly give more examples than I can. For the sake of completeness, a few of the more important psychologic implications of dentistry may be mentioned briefly.

In the first place, the teeth may become

centers of fixation for anxiety states or even neuroses. The anxiety may take one of many forms, such as undue concern over the condition of the teeth, an exaggerated desire for tooth cleanliness and worry over the effects of the condition of the teeth on the general health. This anxiety and over-emphasis on dental health is usually a part of a wider and more extensive neurosis, which takes its origins deep in emotional conflicts, and therefore is in no sense the total responsibility of the dentist. He can, however, help in mitigating some of the worries of these patients.

A great deal of responsibility for the building up of anxiety in these matters rests on the advertisers of dental creams, brushes and mouthwashes. A glance into the advertising pages of some of our American magazines is enough to frighten the wits out of any one. Fear is the compelling motive behind much of this advertising, from the fear of pink toothbrush to the fear of that dread disease halitosis, about which even one's best friend dares say nothing. We have been regaled with the horrors of pyorrhea, acid-mouth, film, etc., until it is a wonder we do not spend most of our time brushing and cleaning our teeth and rinsing and alkalinizing. Of course, a certain amount of care and attention is indispensable to good mouth hygiene, but much of our commercial advertising is distinctly harmful. The understanding dentist can, and does, instil a healthy and sane attitude in the public on these matters. In this respect, he renders his patients a great service.

In another way, the mental condition may be affected by the dental condition. I have reference to the effect produced by poorly shaped, improperly occluding, ugly or irregular teeth on a patient's self-esteem. When present only in minor degree, these defects are indeed usually unimportant, but more serious abnormalities may serve to cause cruel suffering to a sensitive, neurotic person. One need not point out this fact to a group of dental surgeons, especially in America, since, in this country, the art of orthodontia has accomplished great things. By the corrective measures now adopted at an early age, many a patient is helped to attain greater self-confidence and a happy life. The wearing of naturally colored, properly fitting and comfortable artificial plates likewise serves to increase the self-esteem and poise of elderly edentulous patients. The beneficial effects of dental accomplishments in this field are familiar to us all.

As a neuroligist, I wish to close with a tribute to the profession of dentistry. Their wise and skilful assistance is absolutely necessary to the proper management of many neurologic and psychiatric problems. My personal and professional associations with dentists have always been most satisfactory, and I have learned to rely on their aid in many difficult situations. Our consideration of the important points of contact between dentistry and neurology will have been worth while if it has served to emphasize that these two biologic sciences, even though widely separated in their fields of application, are in many ways important adjuncts one to the other.

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MANIPULATION OF WAX: ITS RELATION TO THE CASTING

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MAKING wax patterns and handling wax in general are often thought of as very simple procedures. Any one can soften a piece of wax, force it to place and carve it. It is done every day by dentists all over the country and very few ever stop to think about it—it is *so* simple.

But let us look at it from a scientific point of view. Let us gather all the facts about wax. Let us examine its behavior under different conditions, see how it acts under changes of temperature; how it acts when free to change in form; how it acts when confined within four walls; how it acts when partially confined. Let us see whether it acts in the same way in different types of cavities: those for simple inlays, for step inlays, for mesioclusodistal inlays, and in three-quarter crowns, in full crowns, and in the combination of all these types in the form of bridgework. I believe we shall then realize that there is a world of information which we all have at our command but to which we have failed to give due consideration. And if we give the proper study to this information, we shall find that many of our difficulties are materially reduced.

Six or seven years ago, in a paper read before this society, I made the statement that no casting in gold had ever been made to the accurate dimensions of a wax pattern, that none is being made and that none will ever be made. That was an absolute statement which has never been disputed or challenged.

Now I shall make a similar statement about a wax pattern: No wax pattern has ever been made that will accurately duplicate the structure gone from a tooth when a cavity has been cut, none is being made, and none will ever be made unless the physical properties of the waxes now in use are materially changed.

The laws of physics are baffling us just as effectively in this problem as when we are trying to duplicate the wax pattern in gold.

While it is true that we cannot make an accurate reproduction of a cavity in wax, it is equally true that we *can* approach accuracy in accordance with the efforts we expend and the knowledge we have of the working qualities of the wax we use. The wax we now employ in the casting process contracts on cooling about one one-thousandth of its volume for every five-degree Fahrenheit drop in temperature. Hence, for every fifty-degree drop in temperature, there is a contraction of 1 per cent. And naturally a corresponding expansion takes place with a corresponding increase in temperature.

THE ONE-SURFACE PATTERN

We shall now try to analyze what takes place when we are forming a wax pattern in a simple one-surface cavity, such as the occlusal surface of a molar. We first soften the wax, either over the flame or in hot water. (I cannot see that it makes a great deal of difference which method

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we employ.) We then force it to place in the cavity and hold it under pressure while it is cooling. As long as it is in a soft and moldable state, we overcome the shrinkage by forcing it into a seating in the cavity. From the time the wax ceases to be of a moldable consistency until it reaches mouth temperature, shrinkage takes place toward a common center. Hence, it pulls away from the walls of the cavity. If the compression of the wax is brought about by the patient's biting into it and holding it under compression until it is cooled to mouth temperature, there is a rebound, which is due to the compressibility or elasticity of the wax. Hence, if this surface is not touched, it will be too high in the finished casting. As the inlay has to be polished after it is set, and of necessity this polishing calls for some extra gold to allow for the gold that is polished away, a little excess gold at this point can do no harm. But, because of the shrinkage of the wax in the other dimensions, the pattern will fail to contact the walls of the cavity. If the wax pattern is deficient, the gold casting will be deficient. If we expand the wax pattern the amount of the shrinkage of the gold, or if we obtain the expansion of the mold by expansion of the investment, or by a combination of the two, we shall find that the gold casting is still deficient along the walls, and is still too high on the occlusal surface.

This deficiency due to shrinkage of the wax along the margins is so small in an ordinary occlusal cavity that, from a practical standpoint, it is immaterial. If, however, the pattern should chance to be quite extensive, it might be well to correct for this shrinkage by burnishing the margins with a warm instrument or by molding the wax over against the margins with a hot instrument. The latter method calls for some explanation. It was first described by me in the *Items of Interest* about twenty years ago and in "Table Talks on Dentistry" by Dr. Ottolengui, pages 162 to 177. It is employed in the correction of defective margins of wax patterns of every description.

Let us assume that we have a defective margin in a wax pattern. This defect may be caused by the wax pulling away from the margin on cooling, through either shrinkage or distortion; or it may be caused by cutting in on the margin in carving the pattern, or in some other way. The method of correction is always the same. At any rate, having this defect, we wish to make a correction. If we should insert a hot instrument in the wax at this point, the wax would melt. In such a case, if the tooth is moist, there is excessive shrinkage away from the margin on cooling; if the tooth is dry, the wax will stick to the tooth. Either method means trouble. And burnishing may afford a correction so superficial that, in polishing the finished inlay, the open cement joint will be exposed. Some operators go so far as to make the wax pattern over again in order to make the correction. That is unnecessary. It can be corrected by inserting a hot instrument in the wax a millimeter or two from the defective margin. This will melt the wax at that point. The instrument is then withdrawn until the color of the wax shows that it is starting to congeal. It is reinserted in the soft but unmelted wax and forced toward the cavity margin and over it, and melted wax flowed into the crevice thus produced. The wax is compressed with the same instrument and the correction is made. It makes no difference whether the tooth is wet or dry: the wax will not stick to the wall of the cavity because it is not melted, but merely softened at this point. Moreover, it will never pull away from the margin because it is compressed against it while congealing.

While it takes some time to describe this method of making a correction, the time consumed in practice is actually very short. If the wax pattern is very small, as small a sprue-former as possible is used. The end of the sprue-former is

heated as rapidly as possible and inserted in the wax pattern as far from the margins as possible. If the whole sprue-former is hot when inserted, it will transfer most of the heat into the wax. If the wax is thus softened or melted close to a margin, there will be a pulling away of the wax at that point as it congeals. If that should occur, the margin should be corrected before the pattern is withdrawn. There are some who, because of the danger of distortion, attach the sprue-former to the pattern by melting in some wax between the two. This is usually done by removing the pattern first with an explorer. But, with this method, trouble is often encountered in withdrawing a wax pattern, as in a mesioclusodistal cavity with long parallel walls. With a sprue-former in its center, the pattern can be withdrawn with a minimum danger of distortion. On the other hand, it is quite impossible to handle a wax pattern with delicate margins without some danger of distortion.

THE TWO-SURFACE PATTERN

Let us now take up the two-surface inlay pattern, such as a mesioclusal in a molar or a bicuspid. Assuming that we have a tooth adjoining the cavity, we find that we have a margin of the pattern that cannot be seen or one that, to say the least, is very inaccessible to instrumentation. Because of inability to master a technic for perfecting this wax margin, a great many dentists have resorted to the indirect technic, which, according to the teaching of the day at least, is far from accurate. The wax is forced into the cavity and held in place until it congeals. The occlusal surface is quickly carved as in a one-surface cavity.

Then the trouble begins. We have a great bulk of wax filling the space between the pulpal wall of the cavity and the adjoining tooth. To carve this part of the wax pattern flush with the surface of tooth entails no end of finger skill, a skill far beyond most of us. Some remove the pattern, carve it to a close approximation, replace it and then finish the carving. Others attempt to do the carving while the pattern is in the tooth, with considerable danger of cutting in on the gingival margin. Still others insert a matrix to form the walls of the cavity before inserting the wax. This endangers the proper fulness or contour of wax along the walls and at the gingival margin. If there is a defect in the gingival margin, the pattern is removed, soft wax is added and the pattern is forced to place. The gingival margin is then smoothed down flush with the tooth. But this method entails danger of distortion in all the other margins. Is it any wonder, then, that the indirect method or the indirect-direct method is resorted to by those not equal in finger skill to the task?

But let us get back to the molding of the gingival margin. The pattern can be accurately molded to the surface of the tooth without much finger skill and without removal from the cavity. When the wax has been forced to place and allowed to cool, it is chilled still further with a spray of cold water. This causes a shrinkage away from the gingival wall as the pattern is held tightly on the occlusal surface. It places the wax under a strain because it is prevented from shrinking in some directions by the irregularities of the cavity. As the wax returns to mouth temperature, it is relieved from strain. It is freer from "lock" than it is when it first cools to mouth temperature. If a wax pattern is in a condition of strain or "lock" and is removed from the cavity in that condition, the finished casting will not go to place because the gold has not the same elasticity as the wax.

When we have cut away the main bulk of wax from the occlusal and the approximal surfaces, the pattern is cut away down to the approximal bulge of the adjoining tooth. A matrix is passed from this point along the approximal surface of the adjoining tooth to a point gingivally from the gingival margin; or, per-

haps I had better say, rootward from the gingival margin of the cavity. With one finger on the wax pattern and the matrix, holding them steadily in place, an instrument shaped for the purpose is heated and forced between the matrix and the adjoining tooth. The heat from this instrument softens the gingival third of the wax pattern. With the wax thus softened, the matrix is forced toward the cavity until it reaches the tooth beyond the margin. The mate to this instrument is forced in from the opposite side of the tooth, gradually turning or rotating to conform to the surface of the tooth. This procedure not only brings the wax up flush with the gingival margin, but also closes any defect between the margin and the wax pattern. On the buccal and lingual aspects, there is left an excess of wax, which allows for contour to conform to the outline of the tooth. The wax margins are then brought down flush with the tooth, first by carving and then by burnishing with a warm instrument. This leaves the gingival margin open and exposed to view. It is then an easy matter to cut away whatever little wax is left from the matrix burnishing. If the gingival margin of the cavity is close to the adjoining tooth, these instruments are used as wedges to force the wax against the cavity. This technic for perfecting the gingival margins of wax patterns, as well as the technic for correcting other margins, I first described more than twenty years ago.

Where the wax was cut away down to the contact point, it is filled in again. With the margins of wax perfected, a small sprue-former is inserted in the bulkiest part of the pattern. The pattern is chilled again and carefully removed by means of the sprue-former. The facet on the wax pattern showing the contact point of the adjoining tooth is filled in slightly to allow for polishing.

It may be out of the sphere of this paper, but at this point I wish to warn the young man, and the older as well, who has not experienced or observed the dangers arising from setting an inlay with too tight a contact with the adjoining tooth. We may tap the casting to place with ease when trying it in the cavity without cement, but, when cementing it, we are liable to fail to seat it properly and to discover the discrepancy when it is too late. But that is not the greatest danger. If the adjoining teeth are in normal occlusion and balance with the opposing teeth before the inlay is set, they are quite sure to be out of balance and normal occlusion after the casting is set. The spreading of the adjoining teeth because of too tight a contact point will produce interference of their cusps with the cusps of the opposing teeth. This means a traumatic occlusion which it is not so easy to correct; and especially is this true if we are not aware of the cause. But let us get back to wax manipulation.

THE MESIOCLUSODISTAL PATTERN

The mesioclusodistal wax pattern is treated similarly to the mesioclusal or the distoclusal pattern; but it calls for a little more wax expansion. Even in mesioclusodistal inlays, there is a difference in the amount of expansion required to compensate for the shrinkage of the gold as it congeals. When the wax is forced to place, there is, of course, a shrinkage; but, in this case, there can be no shrinkage from the mesial to the distal pulpal wall. There will, therefore, be a change in the relation of the molecules of wax to one another or a strained condition of the wax between these two points, or both. When the wax reaches a certain point of hardness in chilling, the molecules can no longer change their relationship and a breakage is the result. This stage of hardness cannot be reached in the mouth because the living teeth cannot be subjected to such severe chilling. When the wax gets back to mouth temperature, the strain or elastic lock is relieved because the wax is free to expand between the mesial and distal pulpal walls. We have, therefore,

expanded the wax pattern between the two pulpal walls by chilling it.

The mesioclusodistal pattern with a bulky occlusal surface requires the greatest amount of expansion to compensate for the shrinkage of gold. In such a case, as the gold passes from the molten to the solid state, the less bulky parts congeal and complete part of their shrinkage before the occlusal portion starts to congeal. As the bulky occlusal portion congeals, the shrinkage produces a pull on the mesial and distal portions and there is a maximum of shrinkage mesiodistally. In such a case, the shrinkage is minimized by the insertion of a larger sprue-former and the placing of the pattern closer to the crucible. This allows for more feeding of gold into the mold as the gold starts to congeal. But if the occlusal portion is thin and the mesial and distal portions are bulky, the occlusal portion cools and completes a great deal of its shrinkage while the mesial and distal portion are still molten or too near the molten state to compress the investment. In such a case, the shrinkage mesiodistally will appear very slight. Hence, a lesser amount of compensation is necessary to allow for the shrinkage of the gold. The greatest shrinkage or tendency on the part of the casting to bind occurs where all parts of the mesioclusodistal inlay are bulky; which calls for the most careful chilling and margin corrections before removal of the pattern from the cavity. The least shrinkage or tendency to bind occurs in thin inlays, and these call for the least chilling before removal of the pattern from the cavity.

The total of the contraction of the gold on congealing is of course the same for all castings, but it is not the same at all parts of the casting; hence, the greater and the lesser tendencies to bind. If we had only the amount of shrinkage of the gold away from the margins to contend with, we should have little to worry about. But very slight shrinkage at one point may greatly increase the difficulty of seating the casting. And this is the principal danger from the shrinkage.

THE THREE-QUARTER CROWN

A three-quarter crown wax pattern requires the least expansion to compensate for shrinkage of gold, especially if it is thin. The best results are obtained by thoroughly chilling the wax pattern and allowing it to return to mouth temperature. All strains or tensions are then gone before the pattern is removed from the cavity, and it fits loosely. At this stage, the margins are burnished or corrected as before described. We then have a wax pattern that fits closest at the margins.

Why should a pattern of this shape call for less expansion to compensate for shrinkage of gold? As the gold passes from the molten to the solid state, it must reach a certain stage of rigidity before it is capable of compressing the investment. And it must compress the investment in order to shrink. If the investment is able to resist compression by the gold, the casting will be opened up. And the thinner the wax pattern, the longer will the investment resist shrinkage in passing from the molten to the solid state; and the more the thin casting will be opened up. Hence, the less the expansion necessary to compensate for shrinkage.

THE FULL CAST CROWN

The full cast crown is the easiest of all to take care of because it is, or should be, waxed up on a die, usually amalgam. But if we are to depend on the accuracy of the die, we cannot carry out the technic of making dies as taught in the schools today. And we *should* have a die which is an accurate reproduction of the abutment tooth.

As the making of an accurate die is outside the sphere of this paper, we shall start with an accurate amalgam die of the abutment tooth. This is covered with warmed cocoa butter, which is then wiped off as cleanly as is possible with a towel. A cone of wax is softened and flattened

out. It is then forced to place over the abutment tooth in the mouth and the patient is asked to close in centric occlusion. When cooled, the wax is carved to give a fair outline of the buccal surface. The wax pattern is removed and placed on the amalgam die. Wax is flowed in down toward the gingival margin and the carving is completed, the facets on the mesial and distal aspects being produced by the approximating surfaces of the adjoining teeth. No matter how well the cocoa butter is cleaned off the die with a towel, no matter if it is washed off with soap and water, no wax will stick to the die; nor will there be any cocoa butter on the wax pattern to be washed off when it is completed. The wax pattern is replaced on the abutment tooth in the mouth and the outline of the gum margin is marked on the wax with an explorer. The occlusal surface is softened quickly with a hot wax instrument or a blast of hot air.

The patient is then directed to perform the various mandibular excursions, thus cutting out the functional occlusal path in the wax surface. The wax pattern is replaced on the amalgam die, and chilled in ice water if possible; and if ice water is not available, in as cold water as is available. The wax cannot shrink against the die and hence there is a rearrangement of the molecules. Sometimes, the wax will crack occlusogingivally because of shrinkage. This crack is filled in with additional wax on a hot instrument. It is obvious that if allowed to return to room temperature, the wax pattern will expand and will not cling tightly to the die. The wax is trimmed away or filled in to the desired distance beneath the gum line as shown by the explorer tracing made on the pattern when it rested on the abutment in the mouth. The gingival margin is then corrected as before described.

We shall then have a wax pattern for the crown which has a closer adaptation to the die at the gingival portion than toward the occlusal. Do we want this? And if so, why? As the gold passes from the molten to the solid state on congealing, it will start to compress the investment near the occlusal portion because of the greater bulk at that point. That is, when the gold reaches the same stage of rigidity near the occlusal portion as it does at the gingival, it will have a greater tendency to compress the investment near the occlusal portion. Therefore, it will shrink more near the occlusal portion than at the gingival. Moreover, the shrinkage at this point in a full crown is greater than at any point in any other single unit casting. Why? When the arms are placed around an object, the power to compress that object is very limited if the hands do not meet on the other side; but if the hands can be gripped on the opposite side, power to compress the object is multiplied many times. Analogously, in the case of congealing gold in a three-quarter crown and a full crown around the investment, it can readily be seen why there is the greater shrinkage in the full crown and the lesser in the three-quarter crown. But greater expansion of the wax pattern near the occlusal portion will tend to prevent the casting from binding at this point.

Thus it can be seen that proper manipulation of the wax may, in some measure, compensate for the shrinkage of the gold in the circumference of the crown. The investment, too, offers some resistance to shrinkage, but in the direction of the occlusal margin to the gingival margin, it is another story. The wax pattern should be as cool as possible when the gingival margin is corrected. It must be realized, however, that the greatest danger from shrinkage is not the discrepancy caused by that shrinkage, as it is very small in a single unit casting. The danger lies in the fact that shrinkage between some points prevents the casting from being seated.

PREPARING THE WAX PATTERN FOR INVESTING

When the wax pattern has been sprued and removed, it is not ready for investing.

It must first be thoroughly cleansed. This should be done immediately on removal and before the saliva dries on the pattern. If saliva is permitted to remain on the wax pattern, it will mix with the investment and, owing to its acid reaction, produce a faulty setting of the investment at that point. This is the cause of many rough surfaces on gold castings. This covers pretty well the single unit castings, with the exception of dummies for soldered bridges. These will be considered in the description of the method of waxing a bridge.

ASSEMBLING THE WAX PATTERN FOR ALL CAST BRIDGE

Let us assume that we have the amalgam dies for a five-tooth bridge transferred to a stone model that is mounted on a plain line articulator. Opposed to these dies on the articulator, which is set at the correct or chosen vertical dimensions, is the functional occlusal path of the opposing teeth in stone. The matrix supporting the facings is in place on the model. The dies and the functional occlusal path are covered with cocoa butter and wiped clean to prevent the wax from sticking.

Let us follow the steps in the waxing of one abutment. The wax is softened and forced to place over the abutment die. The occlusal surface is softened with a hot spatula and the articulator is quickly closed. This forms the occlusal surface.

If a pattern is to be expanded to its limits while on the die, a matrix is placed around the wax before the articulator is closed, and the matrix is tightened, the wax pattern being under the greatest pressure possible. With the matrix around the pattern, while still on the die, the latter is placed in ice water. The wax pattern will expand when it returns to room temperature, not only because of the increase in temperature, but also by virtue of the rebound with the release of the tension or pressure it is under.

Wax is elastic. If it were not, a great many patterns could never be withdrawn from their cavities. Often when a wax pattern has been withdrawn with comparative ease, the completed casting cannot be seated as expected. We then look for undercuts. The wax will spring by, but the gold will not. This is shown to a marked degree when we try to seat a mesioclusodistal inlay or a three-quarter crown with an undercut but with smooth surfaces. It apparently fits very snugly as we attempt to force it; but suddenly it snaps by, and we find that it is not tight at all. A slight undercut, such as is produced by a slight roughness in the surface, can do little harm. The gold can easily be trimmed away afterwards if the inlay fails to be seated, but long walls of a preparation such as a three-quarter crown with undercuts produce a major distortion which cannot be corrected. So much for the elasticity of the wax.

The die is now removed from the model and the waxing of the abutment is completed as with a single crown. It is chilled and corrected in a similar way. Each abutment receives the same treatment as in the mouth, with the exception of the occlusal surfaces, which are formed from the functional occlusal path of the opposing teeth. If the dummies are porcelain root tips, the wax is first forced to place over the pins and carved approximately, with the exception of the occlusal surface. The dummy is set to place on the model with the facing seated against the matrix. Wax is filled in up to the abutment. The occlusal surface is filled in with soft wax and the articulator is quickly closed. This establishes the occlusal surface.

The dummy is then removed and chilled in ice water. The wax is removed from the porcelain, and with a No. 65 steel drill, holes are cut through the wax from the gingival end of the pattern to the pin holes. Between these drilled holes, the wax is cut out to the depth of the pin holes with a little chisel made from a fissure bur. The wax is then replaced on

the porcelain facing and the margins corrected as before described.

Each dummy is treated in a similar way and set to place with the porcelain against the matrix. These openings, as well as the pin holes, are filled with investment material, doing away with carbon points and the blow holes that often follow, and, in the finished casting, the cement flows in and completely fills the pin holes.

The dummies are attached to one another or to the abutments in such a way as to produce an open joint between each two abutments. The sprue is inserted half way between the ends of the bridge. If the bridge is in a straight line, a single sprue without any leads is all that is necessary. If the bridge is on a curve, a counter curve in the form of a wax cylinder is attached to the wax bridge on the lingual surface. This is attached only at one end until the wax is thoroughly chilled. If the counter-curve wax cylinder is not used, the bridge will be distorted. This is especially true in an anterior bridge.

The model carrying the bridge is inserted in a dish of water at a temperature of 50° F. When the wax has been chilled to this temperature, the model is removed and the open joint is quickly sealed with a hot wax instrument. The model is replaced in the cold water. It is removed a few moments at the time for the removal of the facings. If the model is kept out too long while the wax bridge is in place, the expansion causes a distortion of the individual patterns. If the wax bridge has not reached the temperature of the water when it is tacked together or if too much heat is applied in tacking it together, one of the wax joints will break open when the wax bridge is chilled. The reason for this chilling is to allow the wax bridge to expand through a definite range of temperature to compensate for the shrinkage of the gold in casting.

SUMMARY

While I have gone into considerable detail in describing the behavior of wax under different conditions and how to take advantage of this behavior, which might otherwise prove to our disadvantage, it is not with the intention of advising you to follow out all these details in all cases. There are, however, a few fundamental points in this paper which I wish to emphasize above all others.

1. The chilling of the pattern before the carving and correction of the margins.

2. The correction of all defective margins by the insertion of a hot instrument away from the margin and the forcing of the softened wax toward the margin before flowing in additional wax and compressing.

3. The molding of the gingival third of approximal wax patterns with the aid of a matrix, which is forced toward the margin.

4. The use of cocoa butter on all stone or amalgam dies to prevent the wax from sticking. Remember that all excess cocoa butter is cleaned from the die before the soft wax is molded over it.

5. The treatment of the wax pattern on the porcelain root tip to eliminate the use of carbon points and all the troubles that follow their use.

6. The thorough cleansing of all wax patterns to eliminate the danger of roughness due to the mixture of saliva with the investment.

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PRESENCE OF BACTERIA IN PULPS OF INTACT TEETH

By Ruth Tunnicliff, M.D., and Carolyn Hammond, M.A., Chicago, Ill.

THERE are many observations that a large percentage of pulps from intact teeth contain bacteria. McDonagh,[1] with an especially careful technic, has found them in as many as 65 per cent of cases examined. No one appears to have determined whether, after the use of antiseptics, and before the pulp was removed, the surfaces of intact teeth were free from living bacteria. It seemed possible that some of the streptococci isolated from pulps might come from the outside of the tooth instead of from the pulp itself. We, therefore, examined pulps from intact teeth the outside of which had been proved sterile. We found that even after teeth had been incubated eight days, their pulps appeared as normal as those removed immediately after extraction.

Immediately after extraction, the apices and tissue attached to the teeth were seared with a red hot metal instrument and the teeth were put in sterile bottles containing a piece of cotton saturated with salt solution. From one-half to one hour after extraction, the tooth was scrubbed with soap and water with a wire brush. Various methods of sterilization were tried. After the use of antiseptics, the teeth were incubated eight days in deep tubes of 0.2 per cent glucose-brain broth p_H 7 to determine sterility. Subcultures were then made on sheep blood-agar to help identify the organisms and verify the findings in the brain broth culture.

Six teeth were covered with alcohol and flamed to remove the alcohol. Four were not sterile. The alternate alcohol-flame method used (five times) by McDonagh and Henry, Sniffen and Doyle[2] was tried twice. Only one tooth was sterile. Twenty-two intact teeth were placed in tincture of iodine and left for five minutes. The iodine was removed by two washings in alcohol and then the teeth were flamed. Of these, eleven were not sterilized. Since none of these methods was effective, only 47 per cent of the teeth being sterilized, another method was tried. Thirty-four intact teeth prepared as before were placed in 88 per cent carbolic acid for fifteen minutes, washed in alcohol, flamed, put into alcohol for fifteen minutes and flamed again. This method sterilized twenty-five, or 73.5 per cent, of the intact teeth examined. Carbolic acid appears to be more effective than tincture of iodine in killing streptococci. These organisms were found in only two of the nine positive cultures from teeth treated with carbolic acid, but they were present in nine of the eleven positive cultures from those treated with iodine.

To be certain that some antiseptic had not been left on the tooth, thus possibly preventing growth, some of the sterile cultures were inoculated with streptococci. Growth occurred in all whether iodine or carbolic acid was used in sterilization.

PULP

Thirty teeth, externally sterile at the end of eight days' incubation, were washed

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free from brain broth with sterile salt solution, placed in sterile gauze and cracked in a vise sterilized by flaming. The pulp was removed with sterile fine curved forceps and divided with sterile scissors. Smears were made and stained with gentian violet and generally with Giemsa. Pulp was cultured in deep tubes of glucose-brain broth and in semisolid ascites-phosphate-agar made anaerobic with pyrogallic acid and sodium hydroxide.

Twenty-three pieces of pulp were fixed in 1 per cent acid formalin and sections

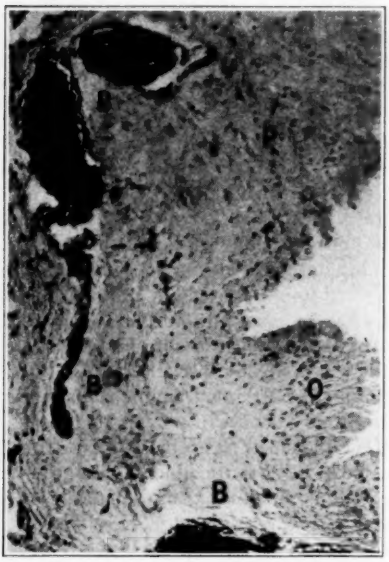

Fig. 1.—Cross-section through pulp of intact tooth incubated eight days, showing masses of streptococci. P, pulp tissue; O, odontoblasts; B, clumps of bacteria. (Gram stain; ×160.)

stained by Gram-Weigert solution, by hematoxylin-eosin and, a few, by carbol thionin.

BACTERIOLOGY OF PULPS

Although the outside of thirty teeth was sterile, bacteria were found in 33 per cent of the cultures from their pulps. Streptococci were isolated from all of these pulps. It was of the viridans type except in three instances, when it did not change the color of blood-agar. Later, these anhemolytic streptococci produced greening. Two strains of streptococci were anaerobic in the first culture. The other organisms isolated from the pulp appeared to be diphtheroids and were always associated with streptococci.

Cultures from pulps of four sterile molars all showed streptococci, while streptococci were isolated from only seven of the twenty-three incisors and cuspids examined.

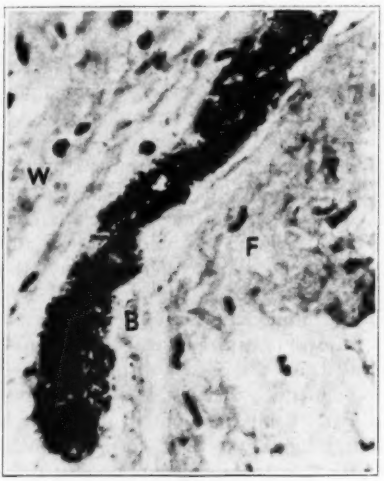

Fig. 2.—Area shown in Figure 1. B, masses of bacteria probably located within a small pulp vessel; F, fibroblasts (pulp cells); W, wandering cells. (×700.)

HISTOLOGY OF PULPS

Histologically, these pulps from intact teeth showed varying amounts of fibrosis and calcification of the pulp tissue and vacuolization of the odontoblasts.

Although pulps from intact sterile teeth might contain bacteria, they showed no signs at all of infection as indicated by leukocytic infiltration. When bacteria were present, they were generally in such large numbers as to suggest multiplication

in the pulp during the eight days' incubation of the tooth. They were present generally in clumps in a circumscribed (Figs. 1-2) area, but because it was possible to distinguish the wall of blood vessels (Fig. 3) only occasionally, it cannot be said definitely that the bacteria gained entrance always through blood or lymphatic vessels. In some instances, the cocci and bacilli were localized in different parts of the pulp. With two exceptions, the bacteria observed in smears and cultures were later seen in sections of tissues.

Fish and Maclean[3] believe that the ordinary manipulation of a tooth during extraction pumps the streptococci by way of the periodontal membrane into the blood spaces as described by Fish and Maclean. In sections from two pulps, large clumps of poorly stained bacilli and cocci were observed at the edge of the pulp. These were similar to clumps of bacteria seen in sections of pulp from carious teeth. These observations indicate that extraction without cauterization does not pump bacteria into the pulp in every instance.

Our findings are in accord with those of Fish and Maclean that, histologically, streptococci may be demonstrated in pulps of intact teeth without any evidence of infection.

Kretschmer and Seybold[4] conclude from their observations that since pulps with stones in non-carious, non-pyorrheal

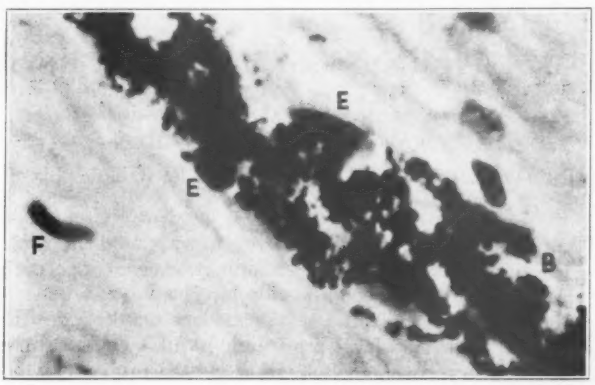

Fig. 3.—Cross-section showing streptococci in blood vessel. B, masses of bacteria located within a small pulp vessel; F, fibroblasts (pulp cells); E, endothelial cells of vessel wall. (Gram stain; ×1900.)

and lymph vessels; and that if the pocket is first cauterized, no bacteria will be found in the pulp. Unfortunately, they cultured only three pulps. Although the pulps cultured by us were all from teeth extracted without cauterization, only 33 per cent of sterile teeth showed streptococci in the pulp.

Twelve apparently intact incisors and cuspids extracted without cauterization and sterilized with carbolic acid as before were opened at once without culturing the tooth. Sections of these pulps showed no bacteria in or near blood vessels and lymph teeth show 92 per cent pure cultures of streptococci, such teeth should be extracted. Calcification was observed by us in 54 per cent of pulps from sterile intact teeth, 58 per cent of these being associated with streptococci. Our experiments would suggest that since there was no indication of infection in these pulps with calcification, with or without streptococci, the streptococci isolated by Kretschmer and Seybold might be of no significance. Fish and Maclean came to the same conclusion from their finding of no infection in intact teeth showing calcification. This

reasoning seems justified by the presence of calcifications in from 80 to 87.2 per cent of all adult teeth as observed by Kronfeld,[5] Hill[6] and Willman.[7]

CONCLUSIONS

Sixty-four intact teeth were treated with antiseptics and cultured eight days in glucose-brain broth to determine sterility. Thirty teeth showing no growth were opened aseptically, and smears, sections and cultures of pulp were studied. *Streptococcus viridans*, occasionally associated with diphtheroids, was isolated from ten of the pulps from externally sterile intact teeth. Since no sign of infection was observed in smears or sections of pulps containing streptococci, their presence is considered of no significance.

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THE MOUTH IN RELATION TO CLINICAL MEDICINE

By John A. Kolmer,* M.D., Sc.D., F.A.C.P., Philadelphia, Pa.

NOT a few dentists appear to be under the impression that the main relationship of oral conditions to clinical medicine is evident in those systemic diseases that may develop secondarily from foci of infection involving the teeth and gingivae. In view of the importance placed on focal infection of these parts in relation to general health by both the medical and the dental profession, it is no wonder that this impression is widespread. But when it is remembered that some diseases of the tongue, buccal mucosa and gingivae are due primarily to disturbances elsewhere in the body and that certain systemic diseases may extend to and involve the mouth, it becomes apparent that the relationship is a much broader one and that the modern dentist indeed requires some training and experience in clinical medicine for the proper practice of his profession.

Certainly it is true that a knowledge of general medicine is required of all physicians specializing in medicine and surgery, and it would appear that since this is demanded of the ophthalmologist, the radiologist, the otolaryngologist, the obstetrician, the gynecologist, etc., the time has arrived when the practicing dentist should know more about clinical medicine than has hitherto been generally the case, if he is to be in all truth primarily a member of the healing art, specializing in treatment of the organs of the oral cavity.

Undoubtedly, the purely mechanistic phases of dentistry have, and properly

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should continue to have, a place of prime importance in the education and practice of dentists, since these alone constitute specialties of great importance in relation to general health, but it appears that these should no more be permitted to engage the sole interests of modern dentists than the purely mechanistic phases of x-ray diagnosis and treatment should be the sole interest of the roentgenologist, or operations on the eye, the sole interest and training of the ophthalmologist.

It is true that the dentist is legally restricted to the diagnosis and treatment of conditions under his specialty, but it is likewise true that the more he knows of the relationship of the condition of the teeth and gingivae to general health, and especially the more capable he is in the recognition of those oral lesions that are but local expressions of disease elsewhere in the body, as well as diseases, such as those of the skin and specific infections, that may extend to the organs of the mouth, the more nearly he will fulfil his prime destiny as a physician specializing in dentistry. Furthermore, such qualifications cannot fail to be ultimately appreciated by the laity and raise to a still higher place of honor in the learned professions both dentists and dentistry.

It is true that the layman does not expect the dentist to treat conditions and diseases beyond the oral cavity, but he has the right to demand and expect that the dentist shall possess sufficient knowledge of clinical medicine to appraise intelligently the state of the general health in relation to the health of the organs of the mouth, as well as to advise consultation with the physician when this is necessary; for without consultation, the effectiveness of the dental service rendered, and indeed the very life and well-being of the patient may be jeopardized.

Furthermore, a knowledge of clinical medicine on the part of the dentist inevitably results in closer cooperation between dentists and physicians in rendering health service on a broad basis, as well as enabling the dentist to read medical literature more profitably, to participate in public health work more intelligently and, above all, to participate more actively in consultations; an ability which at present is wofully lacking on the part of not a few dental practitioners.

This is not the time to discuss the place of clinical medicine in the dental curriculum. Suffice it to state that I keenly realize the crowded condition of the curriculum and the difficulty commonly encountered in providing for adequate didactic and clinical instruction in medicine. But when I pause to consider the tremendous and varied knowledge demanded of the medical student for graduation, embracing as it does not only the fundamental sciences, but likewise medicine, surgery, obstetrics and pediatrics, as well as numerous additional specialties, I find myself with but scant sympathy for the difficulties expressed, especially when it is apparent that better correlation and better division of time allotted to the various subjects of instruction would provide ample time for clinical medicine in the majority of dental schools. Certainly, the Curriculum Survey Committee of the American Association of Dental Schools has made an admirable start in this direction, and I point with pride and satisfaction to the time it has allotted for instruction in medicine as well as to the fact that most dental schools have already provided for courses in this subject. There is no other branch of medicine in which students are allowed to specialize at the outset without a broad fundamental training in medicine and surgery, and I see no legitimate reason that an exception should continue to be made in relation to dentistry.

In this connection, I cannot refrain from encouraging local and national dental societies to provide on their programs for more papers and discussions of clinical medicine in relation to dentistry, and suggesting that local societies at least seek ways and means for providing didactic

and clinical instructions for those practicing dentists who had no opportunity during their undergraduate days for acquiring some knowledge of clinical medicine in general, with special reference to their specialty. I am sure that the medical profession stands ready to cooperate in every way and, in this connection, I may mention in passing that there should be more instruction of medical students by dentists and that medical societies should have more dentists on their programs, in order to seal the close connection between the two professions, to the advantage of both and particularly of the laity.

No better argument need be made for the importance of clinical medicine in relation to care of the mouth than to pass in review the large number of systemic diseases due to dental infection.

IMPORTANT POSSIBLE SECONDARY OR SYSTEMIC DISEASES DUE IN WHOLE OR IN PART TO DENTAL INFECTION

Without doubt, the systemic diseases that may arise secondarily from primary foci of infection about the teeth and gingivae take first place in importance. This is not the place to discuss the mechanism of focal infection. Suffice it to say that at least the majority of physicians and dentists believe such foci to be responsible for disease in many other parts of the body, without inferring that the latter are always and solely due to focal infection.

These diseases are:

1. Of the skeletal system: atrophic or rheumatoid arthritis; fibromyositis; bursitis; osteomyelitis, etc.

2. Of the cardiovascular system: endocarditis and especially subacute bacterial endocarditis; pericarditis; some cases of primary and secondary arteriosclerosis and hypertension; neurocirculatory asthenia; phlebitis, etc.

3. Of the blood and blood-making organs: secondary anemia; some of the purpuras, etc.

4. Of the kidneys: acute and chronic nephritis with special reference to glomerulonephritis; pyelitis and pyelonephritis; perirenal abscess, etc.

5. Of the gastro-intestinal tract: possibly some cases of peptic ulcer; appendicitis, colitis, cholecystitis and cholangitis, as well as other chronic debilitating diseases with gastro-intestinal symptoms, etc.

6. Of the respiratory tract: possibly some cases of chronic bronchitis with or without acquired bronchiectasis and secondary brain abscess; pleuritis and infective asthma with acquired bacterial sensitization, etc.

7. Of the nervous system: neuritis with special reference to glossodynia, trifacial neuralgia, intercostal neuralgia and sciatica; some cases of myelitis and encephalitis, neurasthenia and psychoses or mental diseases, etc.

8. Of the eyes: some cases of keratitis, iritis, episcleritis, cyclitis, choroiditis, panophthalmitis, cellulitis and abscess of the orbit; optic and retrobulbar neuritis; muscle paralysis and thrombosis of the central retinal vein and of the cavernous sinus, etc.

9. Of the ears: some cases of tinnitus due to fifth nerve involvement; vertigo from labyrinthitis; deafness due to auditory neuritis; otalgia of dental origin, etc.

10. Of the skin: some cases of eczema, erythema nodosum, erythema multiforme, lupus erythematosis, urticaria, angioneurotic edema, alopecia areata, purpura hemorrhagica and possibly herpes zoster, as well as such common diseases as acne vulgaris, acne rosacea and furunculosis, which may be aggravated by oral sepsis, etc.

It is in dealing with these diseases that especially close cooperation is required between physician and dentist. And the dentist must or should realize that beautiful and satisfactory mechanical work in the saving of a tooth or teeth may jeopardize the general health. Furthermore,

the matter of extracting infected teeth is frequently one of the utmost importance, since wholesale extractions may so disseminate infection as to result in disaster. In this connection, I may also mention that I, at least, am among those who favor the administration of carefully prepared autogenous vaccines as part of the follow-up therapeutic program when I am convinced that dental sepsis is wholly or partly responsible for systemic disease. Altogether too frequently, infected teeth are extracted and discarded without bacteriologic examination and thereby the opportunity for securing the organism of primary infection, which is so likely to be a streptococcus, is possibly lost forever. Whenever the dentist has reason to suspect that dental sepsis is responsible for secondary or systemic infection, he should delay operative work until the family physician has been consulted. I cannot always guarantee a cordial reception of any advice the former may give, but I can guarantee that the great majority of physicians will welcome just such intelligent and helpful cooperation and that it will inevitably redound to the credit of the dentist on the part of both physician and patient.

Furthermore, when it is remembered that caries, faulty dentition, the absence of sufficient teeth for proper mastication and the like may in time result in gastrointestinal disturbances, as well as changes in physiognomy and the psychic state, it becomes increasingly apparent that the condition of the organs of the mouth has a relationship to clinical medicine that you are able to appreciate even better than the physician.

ORAL DISEASES DUE PRIMARILY IN WHOLE OR IN PART TO SYSTEMIC DISTURBANCES

The important relationship of clinical medicine to dentistry is emphasized even more when we consider that many diseases of the oral cavity are due in fact and primarily to disturbances elsewhere in the body. This is particularly true of some types of recurrent gingivitis, stomatitis and gingivostomatitis, so likely to be treated by the dentist as purely local infections; whereas, in truth, it would appear that at least some of them are due primarily to avitaminoses, endocrine and metabolic disturbances, allergy, disturbances of the hematopoietic organs, general infections or intoxications, etc., with but secondary and relatively unimportant local infection. It is no wonder, therefore, that the treatment of not a few purely by local measures is only helpful at best, without being in any sense completely curative. In this category may be placed the following diseases as indicative or at least suggestive of this important relationship of oral conditions to clinical medicine:

1. Diseases due to deficiency in food factors and vitamins: caries, the result at least partly of a deficiency in vitamin D, of so much importance in the regulation of absorption and the metabolism of the bone forming elements calcium and phosphorus; hypertrophic gingivitis of asthenic children; scurvy due to deficiency in vitamin C; rachitis due to deficiency in vitamin D; pellagra probably due in part at least to deficiency in vitamin B complex (B_2 or G); beri-beri and polyneuritis due to deficiency in vitamin B, etc.

2. Diseases due to endocrine disturbances: the stomatitis, gingivitis and glossitis of diabetes mellitus; the gingivitis of pregnancy and menstruation; the stomatitis (aphthous) of menstruation; the malformation of the teeth and jaws of acromegaly, etc.

3. Diseases due to metabolic disturbances: the stomatitis and the gingivitis of advanced nephritis and especially of uremia; the stomatitis of gout; the aphthous stomatitis of digestive disturbances and so-called auto-intoxication, including the chronic recurrent type (Mikulicz's disease); etc.

4. Diseases due to allergy: gingivitis and stomatitis due to natural or acquired allergic sensitization to substances in lip-

sticks, toothpastes and mouthwashes, as well as to foods and occupational substances; gingivitis due to allergy to plants, the so-called gingivitis venenata, etc.

5. Diseases due to disturbances of the blood and blood-making organs: the chronic recurrent stomatitis of secondary anemia including Mikulicz's disease; the glossitis and gingivostomatitis of pernicious anemia; the gingivostomatitis of the leukemias, so likely to be among the first manifestations of these highly mortal diseases; the hemorrhages of the purpuras, hemophilia and true polycythemia; the severe gingivostomatitis of agranulocytosis with involvement of the fauces, etc.

6. Diseases due to general infections and intoxications: the gangrenous stomatitis (noma) secondary to measles, scarlet fever, pertussis, typhoid fever, etc.; the catarrhal stomatitis of measles, scarlet fever, etc.; the gingivostomatitis of metal, metalloid and halogen intoxications, as in lead, arsenic, silver and phosphorus poisoning, or due to the administration of arsenic, mercury and bismuth in the treatment of syphilis, where oral sepsis greatly reduces tolerance for these compounds; etc.

GENERAL DISEASES WITH ORAL MANIFESTATIONS

Not a few general or systemic diseases may have oral manifestations which the dentist should be capable of recognizing. It is true that the diagnosis of most of them is based upon manifestations other than in the mouth, but in some the oral lesions may be the only manifestations as, for example, in syphilis, sprue, anthrax and actinomycosis. Needless to state, their exact diagnosis by the dentist may be the first and only means of detection which both the laity and the medical profession cannot fail to appreciate and which emphasize the fact that the dentist is or should be primarily a member of the healing art in its broadest and most practical sense.

The general diseases with oral manifestations are:

1. Acute infectious diseases with oral manifestations: syphilis with chancres of the lips, gingivae, tongue and tonsils, as well as the mucous patches of the secondary stage; the rare chancroid of the lips and mouth associated with genital lesions; anthrax resembling parenchymatous glossitis (glossanthrax); the oral lesions of epidemic stomatitis or foot and mouth disease, as well as those of diphtheria, mumps, erysipelas, influenza, chickenpox, smallpox, measles, scarlet fever, pertussis, etc.

2. Chronic infectious diseases with oral manifestations: the numerous and varied lesions of the tongue, including leukoplakia, as well as of the teeth, hard and soft palates, etc., of chronic acquired and prenatal syphilis, including the chronic degeneration of nerve endings in tabes dorsalis; lupus vulgaris, the tuberculous "chancre" and tuberculous ulcer of tuberculosis; the lesions of nodular leprosy as well as those of rhinoscleroma and malaria; the glossitis and aphthae of sprue, gangosa, frambesia tropica (yaws) and leishmaniasis; the gingival and tongue lesions of glanders, as well as actinomycosis of the tongue, gingivae and jaws; thrush and other lesions of blastomycosis and sporotrichosis, as well as the gingival lesions of oral amebiasis, etc.

3. Skin diseases which may have oral manifestations: the dreadful pemphigus, which indeed for years may appear only about the lips and buccal mucosa; lichen planus, in which about 50 per cent of cases present lesions of the tongue and buccal mucosa; the rare epidermolysis bullosa, in 75 per cent of cases of which lesions occur on the lips, gingivae, tongue, buccal mucosa and palate; erythema multiforme in which about 50 per cent of cases show buccal or labial lesions and which indeed may be confined to these parts; dermatitis herpetiforms with lesions of the cheeks; the common impetigo contagiosa, as well as herpes catarrhalis

and herpes zoster with lesions about the lips, tongue and cheeks; lupus erythematosus in which about 10 per cent of cases show extension to the buccal mucosa as well as to the gingivae, tongue and hard palate; scleroderma, in which about 50 per cent of cases show involvement of the tongue as well as the cheeks; the pigmentations of Addison's disease; advanced pulmonary and abdominal tuberculosis, congenital heart disease, jaundice, hypertrophic cirrhosis of the liver, metallic poisonings, pediculosis corporis (vagabond's disease), etc., as well as such common diseases as eczema, erythema nodosum, urticaria, angioneurotic edema and alopecia areata, sometimes due to focal infection of dental origin. In this category is also to be placed such diseases as acne vulgaris, acne rosacea and furunculosis, sometimes aggravated by oral sepsis, as previously mentioned.

And this by no means exhausts the diseases of clinical medicine of particular interest to the dentist. He should also have some first hand and practical experience in diseases of the heart and circulatory system and especially in relation to anesthesia; of allergy in general, with special reference to hay fever and asthma; of the ductless glands, with special reference to the thyroid, parathyroid and thymus glands; of the gastro-intestinal tract including the liver and gallbladder, as well as of the nervous system; and especially of psychiatry in its relations to dentistry.

I do not wish to infer that the instruction of dentists and dental students in clinical medicine need be as thorough as is required of physicians and medical students, but I hope this brief review of the subject will lend support to the widespread and growing opinion that the dentist needs some training and experience in clinical medicine. Furthermore, the instruction should be as practical as possible and it is from its very nature inseparable from the hospital and clinic. There is the more reason, therefore, for bringing the schools of dentistry into the closest possible relationship with medical schools and hospitals; which has the added advantage of close contact between medical and dental students to the mutual advantage of both, as well as showing by example the close relationship that should exist between the two professions, which are, after all, only branches of the great healing art.

Furthermore, I believe that every dental school should have a medical clinic under a capable staff, not only for the general study of patients referred to it from the operative dental clinics, but also as a place for direct and frequent contact of senior dental students with clinical medicine and for a thorough discussion of the numerous diseases and problems common to both the medical and the dental profession.

STATE MEDICINE AND SOCIAL SECURITY

By Morris Fishbein,* M.D., Chicago, Ill.

THE propagandists and proponents of various forms of state medicine continue their persistent campaign for a change in the nature of the practice of medicine and dentistry, although the fire and fury with which they urged their point of view in 1932 has somewhat abated. Whether they believe that they have achieved their aim because of the passing of the social security legislation and are willing now to await gradual evolution, or whether they have actually lost the public esteem is a matter for debate and consideration.

The Social Security Act is, of course, primarily concerned with unemployment and old age security. It makes available for public health authorities a considerable sum of money beyond anything heretofore available, the funds being administered under the control of the United States Public Health Service and of the state public health departments, with the stipulation that they provide primarily for such matters as infant and maternal welfare and the care of the crippled, the blind, the hard of hearing and others who are handicapped.

Dentistry benefits but slightly under this legislation; in fact, only as far as public health officials may find it advantageous to engage in dental projects with these funds.

The economics of dental practice represent, of course, a different story from that concerned in medical practice. Whereas the Committee on the Costs of Medical Care found that only one-fifth as many persons received any dental attention in the lowest income group as in the highest, the amount of money spent for dental care each year seems to be approximately $485,000,000, which is about half the amount spent on medical care.

The dental profession is also concerned with the fact that there are certain sections of the country in which a living for a dentist seems so utterly impossible that dentists simply will not go there. For example, the figures seem to show that there were nineteen dentists for every 100,000 population in the state of Mississippi in 1928; whereas, in Oregon, there were 101 dentists for every 100,000 people.

None of the foreign systems available really gives anything resembling adequate dental service. The German practice is greatly limited. The British system pays only a fraction of the cost of dental care, which is inadequately correlated with the medical service. The inadequacy being recognized, there is now a tendency to endeavor to embrace more dental service and specialistic medical service as well.

In a recent survey entitled "Sickness and Insurance," Harry A. Millis, of the University of Chicago, has traced the trend of movement for compulsory health insurance in the United States. This matter has now been before the American dental and medical professions and the public for more than twenty-five years, during which time it may be said that the movement seems to have made but slight progress, since it is hardly in such good favor now with the medical and dental professions as it was twenty-five years ago. In fact, the present period seems to be an at-

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tempt at revival of a creature born in 1911 which died about 1920, and which, it would seem, is to come upon the world in a new dress.

The Epstein bill, which has been repeatedly introduced into various state legislatures, has invariably failed. It now appears in Congress under the egis of Senator Capper, offering a type of minimal dental service almost as inadequate as no service at all and without any real consideration of dental needs.

At present, the movement for and against state medicine appears to hang definitely on the question as to whether any considerable percentage of our people actually lack adequate medical care and adequate dental service. Those who urge compulsory sickness insurance and other forms of state medicine insist that the majority of the people are without adequate medical care. In fact, John Kingsbury insisted that the poor were all without adequate medical service and that it was no use to give them a voluntary sickness plan because they would not accept it.

The studies of the Bureau of Medical Economics of the American Medical Association indicate that, within a small margin of error, about 50 per cent of the population goes through the year without any illness. Fifty per cent of the illnesses of the other half are not disabling. One-half of the remainder, or about 12.5 per cent, are of a minor character, such as the common cold, and involve a disability of less than a week. This leaves about 12.5 per cent who have serious illness and an expense for wage loss and for medical care sufficient to constitute a real problem. Of these, many are able to meet the necessary expense from their own savings, by deferred payments or from regular income, just as they meet other extraordinary expenses. Thus, it seems reasonable to assume that 5 per cent—certainly less than 10 per cent—of the total population are unable to meet their sickness expense without great sacrifice. This is still enough of a problem to always deeply concern organized medicine. It is a testimony to the accuracy of these figures that when county medical societies have set up machinery to provide medical service for those otherwise unable to obtain it, the number served has almost invariably been between 3 and 5 per cent of the total population.

Indeed, the American Medical Association has condemned the state medical schemes as they might apply in the United States on the grounds that not one of the systems developed abroad has been a success. We are confronted with the constant danger of political manipulation, all of the systems concerned encouraging malingering, multiplying medical visits and tending to develop a psychology of sickness. There is no evidence that any system leads to lower mortality or morbidity rates, and invariably they multiply the costs of sickness beyond what they were in the past.

More than anything else, the medical and the dental profession fear, as part of a communal medical and dental service, a deterioration in the quality of care that would in the end be exceedingly harmful to the American people. All that sickness insurance plans offer as dental service are exodontia, plastic fillings and prophylaxis. More than 90 per cent of the population earned less than $3,000 per family in 1929, yet this same group of people furnished 60 per cent of the practice of 86 per cent of the dentists in this country. There are few, if any, Americans who are willing to accept the kind of dentistry that this insurance offers them and who would be satisfied with it after they had paid for it.

The propagandists who are continuing to urge socialization of medicine on the American people are now making their appeal on the grounds that it will increase the incomes of dentists and doctors, particularly in the lower third of these professions. Most of the articles in popular periodicals are now concerning themselves with dental and medical fees and with the incomes from such practice. The medical profession prefers to look at the matter

from an idealistic point of view and has not yet begun to succumb even slightly to these insidious appeals. There are 165,000 physicians licensed to practise medicine in the United States, but the only organization for socialized medicine has never been able to boast more than 1,200 members.

Every proposal for change in medical and dental service should be tested with the question "For whose benefit?" Unless the change will help, either directly or indirectly, in the fight against disease and death, it cannot be justified. The fact that it may increase the income of physicians, help pay the interest on hospital investment or provide salaries for a body of administrators, unless it will also improve medical service, is no justification. This is a simple test, but applied strictly to many of the proposals for medical changes before the public at the present time, it would elicit a verdict of condemnation.

REMOVING STAINS FROM MOTTLED ENAMEL

By J. Wilson Ames, D.D.S., Smithfield, Va.

Mottled enamel is a developmental defect of teeth resulting from drinking water, and perhaps eating foods, containing excessive quantities of fluorine during the period of tooth calcification.[1] It has been shown that fluorine in drinking water in concentrations of one part or more per million is capable of causing this phenomenon. The affected teeth are usually glazed on the surface. They may be paper-white and void of translucency, or have this paper-white as a background, with areas of yellow or brown in any shade, and even black. These areas are irregular in outline and varied in shape. The most characteristic areas are bands extending across the axial surfaces from the mesial to the distal aspects. Quite often, these bands are zigzag streaks. In some cases, the labial surfaces are pitted. If the mottling is serious enough to render the enamel chalky and flaky, the tooth no longer retains its normal glaze and luster.

Proof that fluorine is the causative factor in this condition may be found in Technical Bulletin No. 52, published by the University of Arizona. The experiments herein described were performed by Isaac Schour and Margaret C. Smith, who experimented on rats. Sodium fluoride was employed in these experiments, by diet feeding and also by injections. The two methods show very much the same results. A more accurate check can be kept on the injection type of experiment. Some of the results will be cited.

When 0.3 cc. of a 2.5 per cent solution of sodium fluoride was injected at forty-eight-hour intervals and the rats were killed twenty-four hours after the last injection, the gonoblasts and epithelial papillae were found to be histologically normal. Litter mates were used as controls. The enamel was distinctly stratified, in pairs of layers, the number corresponding exactly to the number of injections. Each pair of layers consisted of (1) a light layer, which represented the primary and immediate reaction to the injection and which was both hypoplastic and hypocalcified, and (2) a dark layer which promptly followed the light one and which represented the secondary or recovery reaction. The pair of light and dark incremental layers in enamel may be regarded as characteristic of fluorosis.

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In the dentin, changes comparable to those in the enamel were found; whereas, the pulp and odontoblasts were normal in appearance.

In U. S. Public Health Bulletin No. 1581 are the results of a survey of the distribution of mottled enamel, showing that about half or more of the forty-eight states have areas, some large, others small, in which mottled enamel is found.

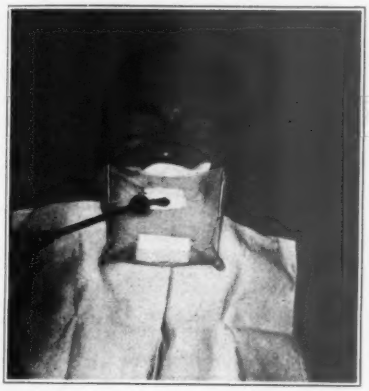

Fig. 1.—Patient being treated.

Fig. 2.—Mottled enamel in patient aged twenty-three.

In a survey which W. C. Ames and the writer carried out, 50 per cent of the students in Smithfield High School, Smithfield, Va., were found to have mottled enamel. The purpose of this paper is to describe a technic for the removal of stains from mottled enamel.

The methods formerly used involved jacket crowns and other mechanical means of restoration, including the very drastic method of grinding the stained portions from the tooth. This method generally resulted in grinding most of the tooth enamel away.

Many formulas were tried which gave limited results in eliminating the stain. Finally, by mixing five parts of 100 per cent hydrogen peroxide and one part of

Fig. 3.—Case shown in Figure 2, after twenty treatments.

Fig. 4.—Mottled enamel in patient aged nineteen.

ether, an effective formula was obtained. The actual technic of removing the stain is as follows: A rubber-dam is adjusted, isolating the teeth to be treated. Gauze exodontia sponges should be packed all around the dam for safety, because the solution is injurious to soft tissues. The use of rubber gloves is also advised. A shield

of isinglass may be used to shield the patient's eyes and nose. Slipping it under the upper border of the dam will hold it in place.

It is suggested that a length of cotton roll, just covering the teeth to be treated, be tied in place with the free ends of the ligatures used in retaining the rubber-dam. It is advisable to agitate the solution with an eye-dropper before wetting the cotton roll, as the two liquids separate readily. As soon as the liquids are well mixed, the cotton roll may be saturated. Application of a gentle but steady heat to the saturated cotton roll is suggested as an accelerator. For this, a very simple device is used, consisting of the handle of any broken instrument, the end of which has been flattened and then made somewhat spoon-shaped. A hole the size of the handle is drilled in a metal ball. This ball is then slid down as close to the spoon end as possible, for heat accumulation. A suitable wooden handle is fastened to the opposite end. The metal ball may be warmed over the flame of an alcohol lamp or Bunsen burner, overheating being avoided, to prevent devitalization. When the cotton roll begins to dry, it is suggested that the two liquids be agitated again and

Fig. 5.—Case shown in Figure 4, after fifteen treatments.

Fig. 7.—Case shown in Figure 6 after eighteen treatments.

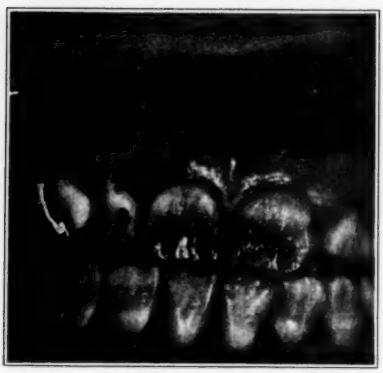

Fig. 6.—Mottled enamel in child aged twelve.

Fig. 8.—Mottled enamel in patient aged twenty-five.

the cotton roll resaturated. Five cubic centimeters of hydrogen peroxide and 1 cc. of ether are the quantities used. This generally lasts about half an hour.

In no instance has the writer had a failure, although some patients have responded better to treatment than others. It is advisable to have photographs made before and after treatment for comparison. It is suggested that a period of two or three weeks elapse between the last treatment and the taking of the final photograph. The reason for this is that the portion of the tooth void of any stain will become abnormally white. After two or three weeks, the tooth will regain its normal color. What the chemical reaction or

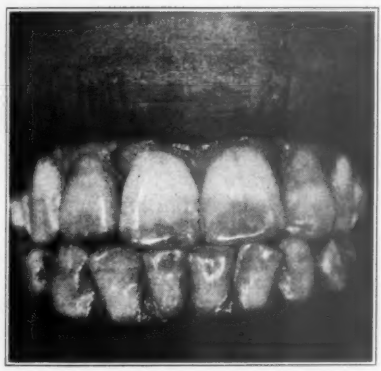

Fig. 9.—Case shown in Figure 8, after twenty-five treatments.

histologic change is the writer cannot say. He has performed no experiments on the subject either chemically or microscopically.

As to the length of time required to complete the treatment, there are many factors to be considered. One cannot forecast the time with any degree of accuracy. A case that appears simple may possibly take longer than a more difficult appearing case. The most difficult and deepest stained cases have been selected, so that the stain would show well in the photographs. As many varieties in type as could be found have also been selected. Among these cases, the number of treatments has varied from five to twenty-five per tooth or group of teeth treated as a unit. The color of staining in these cases varies from light yellow through dark brown and gray to black. The cases seen in this area vary from paper-white to black.

In some cases, the mottled teeth are as resistant to caries as any normal tooth. In other cases, they are very soft, chalky and flaky. The time for the stain to appear on or in the mottling varies. Some teeth are stained on eruption. Some erupt paper-white, the stain appearing later. Others erupt paper-white and remain unstained through life.

In no case treated has there been a recurrence of stain. Three years have lapsed since the first treated case was completed and the patient has been under constant observation.

The first few treatments show a marked change. As the treatments progress, the less marked is the change. The reason for this is that the first few treatments remove the superficial stain. As progress is made, the bleaching penetration is slower.

In this treatment, only the stain is removed: the mottling itself remains.

The x-rays have been used in the experimental work as an accelerator, with no results. The following method has also been used: The solution was heated in a testtube fitted with a rubber stopper and glass tubing. The end of the tubing was drawn out to form a small nozzle. The vapor was directed on the stained portion of the tooth. This procedure was slower in giving results than the cotton roll and hot instrument technic.

With the etiology of enamel mottling known, its prevention becomes a rational and relatively simple matter. This is largely an educational problem. In regions where fluorosis occurs endemically or where a high concentration of fluorine in the drinking water is found, the use of collected rain water from birth until the age of seven years should prevent its development.

ORTHODONTIA AND OTOLARYNGOLOGY

By MERVIN C. MYERSON,* M.D., New York City

THE proximity of the palate to the nose and its related structures, and of the mandible to the ear, brings the fields of orthodontia and otolaryngology close together.

The primitive mouth is formed by an invagination of the epiblast that meets the anterior end of the foregut, which later becomes the pharynx. In early fetal life, the nose and mouth are one large space. At about the eighth week, there grows into this space, from each side, a maxillary or palatal process. The primitive nose is formed by the downward growth of the frontonasal processes, which descend from the frontal region. The descending frontonasal plates carry the incisors and form the intermaxillary or premaxillary bones.

At birth, sutures can be seen between the maxillae and the premaxillae. These sutures run diagonally outward and forward from the anterior palatine fossa to the space between the lateral incisor and the canine tooth. The premaxillae fuse with the maxillae in the third month of fetal life; whereas the premaxillae unite during the first year of life.

Each specialist should be conversant with the problems of his colleague, even though some contend there is not a proven specific relationship between the two fields. The problems which interest both groups are those concerned with the anatomic and physiologic factors in nasal and mouth breathing and those involved in symptoms referable to a disturbed relationship within the temporomandibular joint.

There are many who believe that the oral and nasal cavities assume their morphologic characteristics as a result of facial form, which follows hereditary or familial tendencies. Some believe that accidents, prenatal or postnatal, affect facial form and symmetry. Vitamin deficiency has become recognized as an important prenatal influence. Howe and others have demonstrated that high-arching of the palate and narrowing of the nose can be caused by a maternal diet poor in vitamins, especially those which carry the anti-rachitic factor. This does not, however, explain the familial tendency to certain distinctive facial forms which was just mentioned.

Similarly, narrowing of the nasal floor is generally considered to be inherited and not as due to the influence of adjacent structures. A high palatal arch may be associated with a narrow nasal floor, while many wide nasal floors are associated with high arches. In other words, nasal floor and palatal arch are not necessarily wide or narrow in the same subject. The size of the maxillary sinus would seem to affect the width of the nasal floor. Schaeffer[7] has emphasized the fact that the width of the nasal floor is determined in part by the extent of development of this space.

Injury to the nose at the time of delivery or subsequently is known to cause deflection or deviation of the nasal septum. This condition, according to some, is responsible for most obstructions, which, in turn, are responsible for arching of the palate.

(Read before the North Atlantic Orthodontic Society, New York City, April 21, 1937.)

*Director of Otolaryngology, Kings County Hospital.

There are many theories concerning the non-traumatic deviations of the septum. It is asserted that these deformities do not exist in semicivilized peoples. The nasal septum is located in an unyielding position. A disproportionate increase in its vertical diameter means some bending or deviation. Just what makes the septum change its course of development is not definitely known. Trauma, even extremely slight, may be the determining factor.

The contention that nasal obstruction causes high-arching of the palate would seem to be fallacious. Many low-arched palates are associated with deformed nasal septa. Similarly, many high-arched palates exist without deviation of the septum. An interesting observation lies in the fact that young children who have not been using the nasal passages for breathing, but who have had to rely on a tracheotomy tube for this purpose, display a normally developed palate and nasal septum. This is so even though the tracheotomy tube has been worn for many years. This fact was called to our attention by Baum[2] and has been verified by our own experiences.

Nasal obstruction is frequently due to subacute or chronic sinus disease. Here, the obstruction is due to engorgement of mucous membrane, which fills the nasal passages. It should be borne in mind that allergy is frequently associated with sinus disease.

In recent years, allergy has been studied as a frequent cause of nasal obstruction and as a factor in the production of facial deformities. Duke[4] first mentioned this in 1930. More recently, Balyeat and Bowen[1] have shown that children who suffer from nasal obstructions are prone to rub their noses from side to side or upward. Some twist their noses or mouths by making grimaces in an attempt to get relief from irritation or obstruction. It is easy to understand that there may be excessive overriding of the maxillary incisors as a result of these manipulations and grimaces.

Today, it is generally conceded that adenoids do not interfere with the normal development of the jaws and palate. It seems that the nasal fossae, palate and alveolar processes develop simultaneously and proportionately, and that the facial form is inherent in the embryonic tissues. Of interest in this connection is the study of 222 children by McKenzie.[5] He concluded that adenoids did not interfere with normal devolopment of the jaw and palate.

A valuable contribution to the field of orthodontia and rhinology was made by Mosher[6] in 1909. He pointed out that delay in the eruption of the central incisors causes deformity or hypertrophy of the premaxillary wing above them. This results in septal distortion with a concavity on the involved side and a convexity on the opposite side. The proper shrinkage and adjustment of the premaxillae play an important part in the formation of the palate. The premaxillae must shrink and turn downward so that the incisors are nearly vertical. If this does not occur, there results a deformity which requires the services of the orthodontist.

Mouth-breathing is usually the result of nasal obstruction. It may, however, be due to habit or to overlapping of the maxillary incisors which prevents the upper lip from closing completely. It is a fact that in such cases mouth-breathers are helped by the orthodontist.

Mouth-breathing does not constitute a sufficiently strong physical force to influence the arch of the palate. I believe, however, that the mucous membrane epithelium might become flattened, even hornified, but it does not seem that the volume of inspired air would be sufficient to alter the shape of the maxillary palatal processes.

It is stated by some that orthodontic treatment spreads the jaw and increases its width, thereby overcoming high arching of the palate, and at the same time widening the nasal floor and correcting deviation of the septum. This is not in

accord with experience. Orthodontic treatment appears to attack the alveolar processes and cannot hope to change the width of the nasal floor unless it accomplishes separation at the intermaxillary suture.

It is important that the orthodontist be aware of the presence of nasal obstruction whatever its cause in the patient who presents himself for special treatment. The patient's comfort and future welfare will be safeguarded by attention to this symptom.

The otolaryngologist has recently become interested in the remote effect of change in the position of the condyle within the glenoid cavity. The glenoid cavity becomes enlarged or indefinite in the presence of poor occlusion due to loss of molar teeth, wearing of improper dentures or, occasionally, malocclusion in childhood. The last is no doubt of infrequent occurrence. In the presence of such conditions, the articular cartilage becomes thinner or is completely eroded at the point of greatest pressure. This pressure may be transmitted to the roof of the fossa which is adjacent to the dura, or posteriorly where the fossa is adjacent to the tympanic plate of the temporal bone, which separates it from the external auditory canal. A retroplacement or retrusion of the mandible can result in an erosion of the structures of the glenoid cavity, which invades the canal, causing deafness and a sensation of stuffiness. This condition has been mentioned by Wright,[9] Decker, Prentiss, Goodfriend and others in the dental profession; while, in the medical profession, Costen,[3] Seaver[8] and others have been interested in this problem.

When molars are absent on one side of the mandible or the dentures are too short in their vertical diameter, the condyle has a tendency to move medially. When this occurs, the auriculotemporal nerve may be pressed on and headache and pain result in the vertex region. The chorda tympani nerve, which emerges at the medial end of the petrotympanic (glaserian) fissure, can be so compressed or pinched that there is a burning sensation on the side of the tongue or pharynx.

The roof of the glenoid cavity may be so thinned that the dura, with its rich nerve supply, directly above, will be pressed on and severe temporal headache result.

A series of cases have been reported by Costen in which his patients suffered a variety of symptoms. Prominent among these were stuffiness of the ear, with some degree of deafness; headache, and burning sensations along the side of the tongue and pharynx. By means of anatomic and clinical studies, he showed that deafness in these cases was caused by an undue relaxation of the tensor veli palatini muscle and of the external pterygoid muscle, which, together with the cellular and adipose tissue between them, as a result of misdirected condylar pressure, cover the orifice of the eustachian tube.

We have encountered several cases which illustrate the conditions reported by the authors mentioned.

I have considered briefly some phases of otolaryngology which touch our fields and which are of interest to both groups.

May I take this opportunity to suggest that each group will profit greatly by becoming acquainted with the problems and accomplishments of the other? In this way, we can hope to accomplish more for our patients.

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136 East Sixty-Fourth Street.

ACROMEGALY: A PROSTHETIC MONSTROSITY

REPORT OF A CASE

By Roy L. Bodine, Jr., D.D.S., Dental Corps, U. S. Army, Ft. George G. Wright, Washington, D. C.

SINCE acromegaly was first diagnosed by Marie in 1886, articles dealing with it have frequently appeared in the medical literature. The interest of the American physician in this disease is shown by the fact that nine different articles dealing with acromegaly were listed in "The Quarterly Cumulative Index" of the American Medical Association, January to June 1936. Notwithstanding the extremely abnormal oral conditions produced by acromegaly, not a single reference to it could be found in the dental literature. I am presenting the facts learned while constructing dentures in a typical advanced case of acromegaly.

Acromegaly, or hyperpituitarism, is due to an increased activity of the anterior lobe of the pituitary gland, which is located within the cranial cavity in the pituitary fossa on the middle part of the superior surface of the body of the sphenoid bone. In a general description of this disease, the most outstanding characteristic is the abnormal growth of the soft and bony end parts of the body, of the tongue, jaws, hands and feet. The features become coarse; the nose and lips become quite thick, and the mandible and superciliary ridges become greatly enlarged. The hands and feet increase in size, generally more in width than in length.

True acromegaly occurs when the increased activity of the pituitary gland begins after adult life has been reached. If the hyperactivity commences during childhood or adolescence, before closure of the epiphyseal lines (lines of growth in the long bones), another condition results, called gigantism. In this condition, closure of the epiphyseal lines is delayed and the patient grows to enormous height, as seen in the seven- and eight-foot giants of the sideshows. If this hyperactivity of the pituitary gland continues after the epiphyseal lines have eventually become obliterated, the giant will also develop typical acromegaly.

Dentists are particularly interested in the growth conditions bordering on the oral cavity. According to Keith, who availed himself of all the acromegalic skeletons to be found in London:

1. The width between the last lower molars is increased in the mean by nearly 10 mm., so that the right and left lower molars, in place of being nearer together than the uppers, are wider apart and project beyond the upper dental arcade.

2. The canines are advanced so as to come more nearly into a transverse line with the incisors.

(Case from the Dental Clinic, Fitzsimon's General Hospital. Presented before the Annual Meeting of the Colorado State Dental Society, Denver, July 9, 1936.)

3. Porous vascular bone is heaped upon the alveolar margin elevating the dental sockets. The vault of the hard palate is thus increased; the mean height of the alveolar margin, measured from the hard palate opposite the second molar tooth, is 17.5 mm. in the acromegalic and 12.5 in English students. Similarly, the lower alveolar margin of the mandible is raised, the tooth sockets being elevated at the same time. . . .

As regards the body of the jaw, growth is seen to have taken place (1) in the alveolar margin, (2) on the mental eminence, (3) on the lower margin anterior to the groove for the facial artery. The most remarkable changes are seen in the ramus; the double process of deposition and absorption has completely altered the character of the ramus. (Fig. 4.) It has become markedly narrower; the region of the angle has been absorbed and hence the appearance of an opening-out of the angle between the ramus and the body of the jaw in the acromegalic. The ascending ramus has increased in height. Its average height in the normal, as measured from the lowest insertion of the masseter to the upper surface of the condyle, is 65 mm., respectively. The growth has taken place at the points of pressure (temporomaxillary joint) and traction (coronoid process).* . . . Another growth change is caused by absorption of bone from the inner side of the ramus and deposition of bone on its outer side so that the rami become more widely separated, which increases the width of the mouth and pharynx.

There is a mental deterioration nearly always present in acromegalics which may develop into a depression, sometimes reaching the point of suicidal desire. At any rate, "mild psychoneurotic symptoms, such as apathy, feeling of inaptitude for work and moodiness, occur in a very large number of cases of acromegaly."

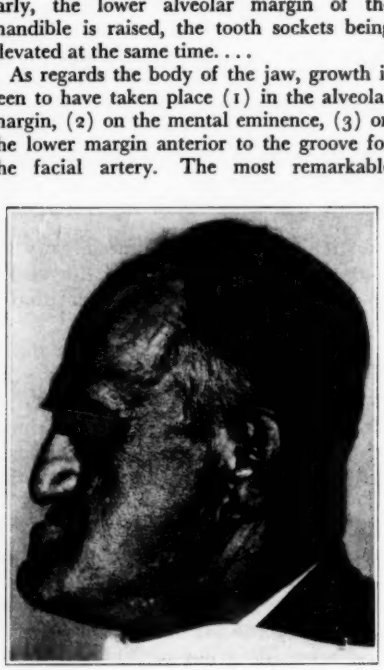

Fig. 1.—Case of acromegaly. Dentures made in 1927, showing apparent close-bite protrusive relationship, due principally to the enormous lengthening of the rami of the mandible.

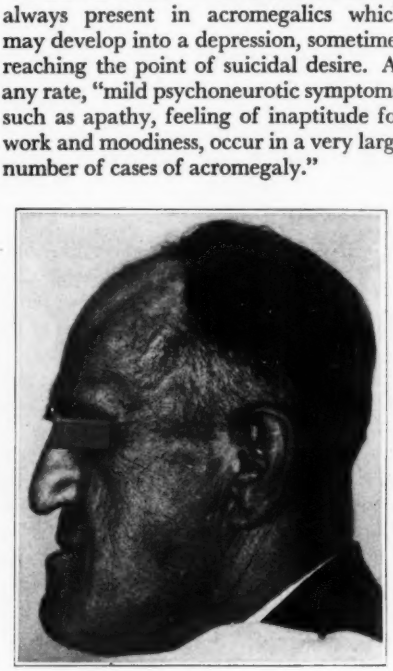

Fig. 2.—New dentures in place. The bite has been opened more than one-half inch. Photographs taken after four months.

CASE HISTORY

The patient is a male, forty-four years of age. He was born in Colorado, living since early childhood in Denver. All heredity and early history are essentially negative, except a complaint of a weak back since early manhood. In 1917, he developed an aching pain in the dorsal spine, which became progressively worse until the case was diagnosed as Pott's

*Bassoe, Peter: "Endocrinology and Metabolism." New York: D. Appleton and Co., Vol. 1, 1924.

disease (tuberculosis of the spine). He gradually developed a kyphosis (bowing) of the dorsal spine, a condition always associated with acromegaly, and the true diagnosis was established. About 1924, he noticed that he required a larger shoe than he had been accustomed to wearing, and at the present time he wears a size 12-E, whereas originally he wore a 9-C. There has been a marked increase in the size of his head, hands and face, particularly the mandible, accompanied by the characteristic coarsening of his features. (Figs. 1, 2 and 3.) The accompanying roentgenogram (Fig. 7) shows quite clearly the changes previously described in the mandible and superciliary ridges.

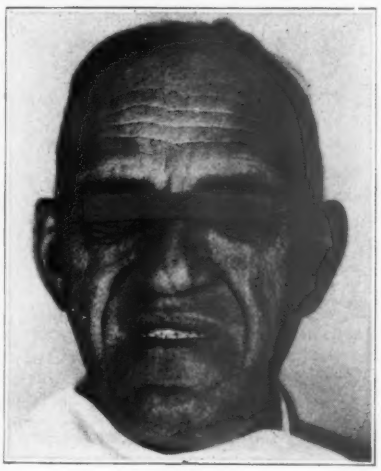

Fig. 3.—Front view, showing occlusal plane. Note that the enormous lower denture is covered by the lower lip without difficulty.

Treatment in various hospitals for acromegaly has been without any apparent relief of the condition. His libido has been low for several years, but he has not yet become impotent, as is usual in advanced acromegaly. His mental condition shows some signs of deterioration, although not particularly pronounced. There is some loss of memory of recent occurrences, although distant events remain remarkably clear in his mind. He is somewhat incoherent in his stories, and occasionally appears confused. He has never had more than moderate headaches, although he complains of some loss of vision. Since his vision is 20-30 in each eye with glasses, his eye complaint is probably due more to his advancing age than to the acromegaly.

Diagnosis.—Acromegaly, severe, with kyphosis of the dorsal spine secondary to the acromegaly.

Etiology.—Completely unknown. Heredity, pregnancy, acute infections, trauma and fright are mentioned as possible causes, but none are applicable to this case.

Prognosis.—Favorable for the life of the patient, although decidedly unfavorable for ever effecting a cure of the disease. One of several things will happen: 1. The acromegaly will continue advancing slowly, with little or no effect on his life expectancy. "Acromegalics have been known to reach the age of one hundred years." (Leri.) 2. It will remain practically stationary, which is what now seems to be happening in this case. 3. It will suddenly burn itself out and become a hypo-activity or pituitary deficiency, producing the typical symptoms of adiposo-genito-dystrophy, characterized by a large accumulation of fat around the abdomen, hips and breasts, assuming a female distribution. In this case the patient will be greatly benefited by glandular therapy with pituitary extract.

Treatment.—While many types of treatment have been tried, none gives satisfactory results except the surgical removal of all or part of the anterior lobe of the pituitary gland. This is an extremely hazardous operation because of the location of the pituitary gland within the cranial cavity, above the body of the sphenoid bone. It has a mortality rate of slightly less than 10 per cent, and results in a small proportion of cures or decided improvement. This operation is performed only when a definite tumor has de-

veloped, producing the terrific headaches symptomatic of intracranial pressure, the eye condition eventually terminating in blindness.

Radiotherapy is a rational treatment, but satisfactory results have not yet been obtained.

DENTAL HISTORY

The patient states that his deciduous teeth were all sound and were shed normally. His permanent teeth were sound and occluded properly, with average overjet and considerable overbite, as he distinctly remembers his lower teeth striking the roof of his mouth and making it sore. In 1921, at twenty-nine years of age, all his upper teeth were extracted and an upper denture was constructed. The only reason he can give for extractions at that time was the presence of many large fillings and several pulpless teeth. On this denture the upper teeth were brought forward, an end to end bite resulting. This would seem to indicate that considerable change had occurred in the mandibular relationship prior to this date and was probably a factor in the extractions. The patient thinks that the most rapid changes in his face occurred between 1917 and 1921.

In 1925, four years later, a new full upper denture was made. While he does not remember much change in the occlusion from that of the original denture, he thinks the new one differed mainly in that the anterior teeth had a much more pronounced labial inclination, suggesting that the condition was undoubtedly progressing.

In 1927, at the age of thirty-five, his lower teeth were extracted at the Denver University, College of Dentistry, because of periodontoclasia, and his first full upper and lower dentures constructed. They were given a typical cross-bite set-up, and showed considerable opening of the bite and an extreme protrusion of the mandible. No doubt, they satisfactorily restored the occlusion at the time of construction. However, two years later, the patient thinks that the occlusion had definitely shifted and that by 1934 there was practically no occlusion at all. He continued to wear the dentures regardless of their lack of occlusion and was still wearing them when he came to our clinic in June 1936. (Figs. 1 and 8.)

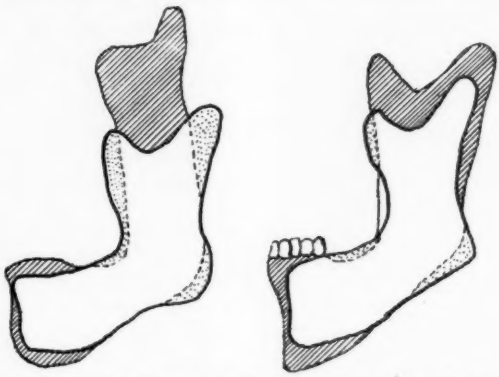

Fig. 4.—"Drawings of lower jaw from cases of acromegaly contrasted with drawings from normal English skull (indicated by heavy outline). The dotted areas are those which are absorbed; the shaded, those which are deposited." (After Arthur Keith, *Lancet*, London, 1911.)

CONSTRUCTION OF DENTURES

Muscle-trimmed impressions were made, and the bite was taken with wax bite-plates in the ordinary manner. In taking the bite, the great extent of the

abnormality became apparent. The upper bite-plate was not appreciably large, although the wax rim was necessarily extended somewhat labially and buccally to the ridge. From the crest of the ridge to the occlusal plane measured 10 mm. in the anterior part and 7 mm. in the first molar region. The lower bite-plate was truly a monstrosity. (Fig. 6.) The distance between the crest of the ridge and the occlusal plane was 31 mm. in the anterior part and 26 mm. in the first molar region. The bite had actually been opened more than one-half inch without producing a strained appearance to the face or difficulty in closing the lips. The occlusal plane appeared to be in approximately the correct position. (Fig. 3.)

Fig. 5.—Cast mounted with face-bow, showing the excessive protrusion of the mandible and opening of the bite, due principally to the enormous lengthening of the ramus of the mandible.

When the casts had been mounted with the facebow on the Hanau articulator, a more satisfactory survey of the conditions could be made. (Fig. 5.) In centric relation, the distance between the crests of the upper and lower ridges measured 41 mm. in the anterior part and 33 mm. in the first molar region. The crest of the lower anterior ridge was 13 mm. anterior to the crest of the upper anterior ridge, measured from a perpendicular to the established occlusal plane.

When the bite was closed to approximately the relation of the dentures made in 1929 (Fig. 8), the conditions became absolutely impossible. The actual distance between the upper and lower anterior ridges was then 31 mm., but was only 25 mm. when measured on a perpendicular to the occlusal plane. The crest of the lower anterior ridge became 18 mm. an-

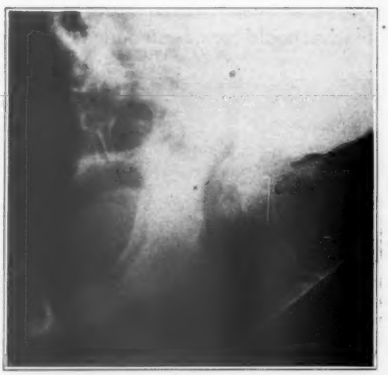

Fig. 7.—Roentgenogram of case, showing protrusion of the mandible and opening of the bite, due to the excessive length of the ramus.

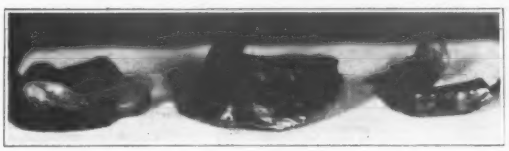

Fig. 6.—Bite-plates, showing malproportion of upper and lower; also comparison to an average lower.

terior to the crest of the upper ridge, an increase of 5 mm. The angle formed between a line through the crests of the anterior ridges and the perpendicular was 25° in the opened-bite relation but became 47° in the closed-bite relation. Thus it was impossible to restore any satisfactory occlusion with this closed-bite relation. As the opened bite was well tolerated, it became possible to establish some degree of occlusion.

In presenting my attack on the problem, I make no claim to having found an ideal solution, but leave it for older and more experienced prosthodontists to decide what could have been done. I selected

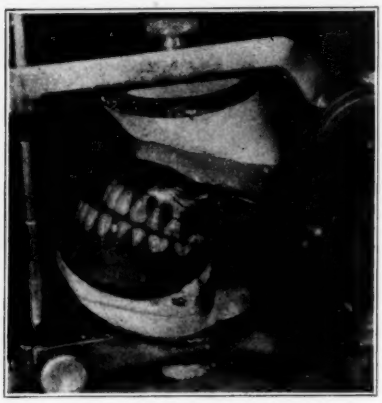

Fig. 8.—Old dentures mounted with face-bow, showing change in occlusal relation over nine years, because of the lengthening of ramus of mandible. Buccal surfaces of upper molars are lingual to lingual surfaces of lower molars.

mold 6-P for the upper teeth, 6-S for the lower teeth and 32-L for the posterior teeth. After considerable experimenting, the upper anterior teeth were set anterior to the ridge, with excessive labial inclination, so that their labio-incisal line-angle just touched the linguo-incisal line-angle of the lower anterior teeth, which were set markedly lingual to the ridge with a lingual inclination. The posterior teeth were set slightly off their ridges, with a typical cross-bite set-up; the upper right posterior teeth on the lower left side, and *vice versa*, the upper first bicuspids being omitted. (Fig. 9.)

The experiment of placing the anterior teeth nearly over their respective ridges and allowing the upper six to be well lingual to the lower six was tried. However, the enlargement of the nose and thickening of the upper lip, the fact that the upper anterior teeth on his old dentures were placed labially to the ridge and the personal ideas of the patient as to his appearance made the attempt to restore some occlusion to the anterior teeth necessary. The freshest rubber obtainable was procured, and the cases vulcanized at 285°

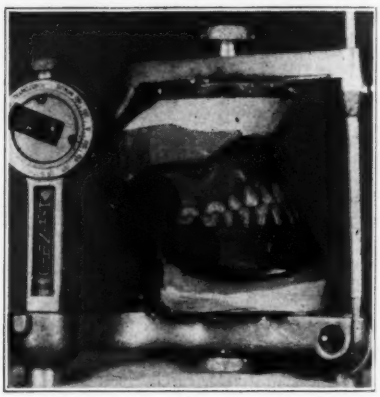

Fig. 9.—Finished dentures mounted with face-bow, showing cross-bite set-up and labial position of upper anterior teeth.

F. for three hours. In spite of this precaution, there were some porous areas present in the enormous lower denture, which were filled in and revulcanized.

When the dentures were placed in the mouth, there was a marked improvement in appearance. (Figs. 2 and 3.) Of course, there was a preponderance in the lower third of the face, but that is characteristic of acromegalics and could not be avoided. The only discomfort from the extreme opening of the bite was the inability to open the mouth as widely as formerly, although sufficient opening for all practical

purposes could be attained. The patient talked distinctly, although rather slowly and with obvious effort. This was due more to the enlargement of his tongue and the thickening of his lips than to the dentures, as he had talked that way for many years. After wearing the new dentures for a few days, it was impossible for him to bring his old dentures (Figs. 1 and 8) into occlusion without practising for ten to fifteen minutes, and then only with great difficulty. He could masticate almost immediately with the new dentures far better than he had been able to for years past, and he was enthusiastic in praise of them. Considering the almost total lack of occlusion of his previous dentures, this was not surprising. He left the hospital still somewhat feeble, but well enough to search for employment.

The patient returned for a check-up four months later, when the accompanying photographs were taken. He had worn the dentures night and day since receiving them and, from his standpoint, they were practically perfect. There was no noticeable further shift in the mandibular relation, an indication that perhaps his condition had at last become somewhat stationary and that these dentures might assure a fairly satisfactory occlusion for some time to come.

SURGICAL PREPARATION OF THE MOUTH FOR FULL DENTURES

By Henry J. Droba, D.D.S., Chicago, Ill.

SURGICAL preparation of the mouth for full dentures has been under discussion for many years. Numerous articles have appeared in the dental publications, some as early as 1876. The *Dental Cosmos* of that year contains an article by Dr. Beers describing a technic for the excision of the alveolus after extraction of the teeth.

Interest in this phase of the practice of dentistry has increased to the point that the program committee of the Chicago Dental Society has seen fit to invite at least three essayists to present papers on this subject before various sections of this meeting.

Mouth preparation was developed by the enterprising oral surgeon as a result of necessity. The busy business man and woman could not and would not tolerate the delay of months necessary for Nature to form the ridge. The period of hibernation was costly and embarrassing. Since the demand came from people who could afford to pay, surgical preparation of the mouth was considered a luxury. The simplicity of the treatment and the exceptional results have caused the luxury of yesterday to become the necessity of today.

The average patient now objects to waiting from two to six months and sometimes longer from the day of his last extractions to the time his dentures are delivered. Nature requires that time to correct, at least partially, some of the irregularities. During this period of soft diet, in which other changes occur, the patient loses a good deal of weight. The temporomandibular articulation, as well as the muscles of mastication, undergo temporary changes from disuse. The in-

(Read before the Section on Oral Surgery, Radiology and Anesthesia at the Seventy-Third Annual Midwinter Clinic of the Chicago Dental Society, February 17, 1937.)

jury is not serious except in causing the patient discomfort for a period after the dentures are finally delivered.

Correct bite registrations are more difficult when the patient has been edentulous for a period of months. It becomes a much simpler task to have the patient give the correct bite when the teeth have been out but two or three weeks.

You will agree that it is a more simple task to construct a satisfactory denture in the ideal mouth, that is, the mouth that has well-rounded, regular ridges, a sufficient vestibule and firm, normal soft tissue, than in one presenting abnormalities either of the bony structures or of the soft tissues. Our objective, therefore, should be the ideal mouth.

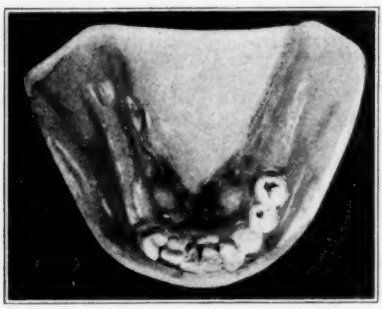

Fig. 1.—Bony tumors on the inner surface of the mandible.

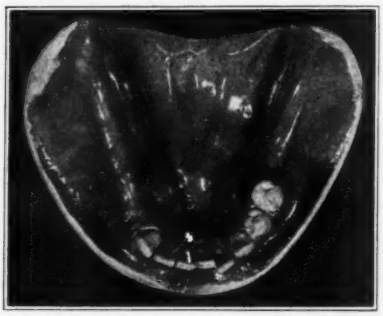

Fig. 2.—After the removal of exostosis.

For many years at the University of Illinois College of Dentistry, we have been making an occasional mouth preparation. The results in these cases proved so satisfactory that, about five or six years ago, we decided to give more attention to this phase of denture service. We found that the time required for healing, the interval between the last extraction and the taking of the impression, is appreciably shortened.

We have used two general methods of procedure: one in which the mouth is prepared as the teeth are removed, the other in which all the teeth are taken out without an attempt to correct any deformities or abnormalities of the ridge. About one week or two weeks after the last extraction, the ridges are prepared for dentures, one at a time.

The argument in favor of the first method, in which the alveolar ridge is corrected at each extraction, is obvious, in that when the last tooth has been removed, the mouth preparation is completed, and, in most cases, no additional treatment is required.

We have found that the second method gives superior results. After all the teeth are out, the deformities can be seen more readily and it is then an easy task to correct them. Results are more nearly uniform with this treatment. The objections come mostly from patients. No one wants unnecessary operations; but if the object and treatment are presented properly, little difficulty will be experienced. Which method is to be used routinely is debatable. The operator's judgment, based on a careful examination of the individual case, is still the best criterion.

In discussing mouth preparation with men in general practice, including their reasons for not offering their patients this service, the first remark, in most cases, is "I cannot get the patient to pay for it." This always reminds me of the discussion I had several years ago about making a

charge for using procaine in cavity preparations. The contention was that it was an added service and should be paid for. My opinion was that since the patient comes to us because he believes he will receive proper treatment, if the treatment indicates the use of an anesthetic, it is our duty to use it and add the cost to the treatment as a whole. I am sure today the majority make that a practice.

Where and how the cost of surgical preparation of the mouth is charged for is relatively unimportant. If we consider this treatment an indispensable service, we can easily make our patients understand the increased costs. However, the time saved in adjustments, in taking impressions and in remaking dentures, more than compensates for the time required to prepare the mouth.

The trend is in the direction of greater service. A great many Class A hospitals are now making no definite charge for the use of anesthetics, operating room or the ordinary drugs. These are considered indispensable. The extra cost is covered by a slight increase in the cost per room. In other words, necessities are not charged as extras: they are included in the cost of service. Similarly, mouth preparation is an actual necessity in many cases, and the fee for such work could well be included in the cost of denture service to the patient.

In this Section, it is my privilege to discuss the subject from the point of view of a general practitioner as well as that of an oral surgeon. In general practice, I appreciate the problems involved in denture construction. As a teacher of minor oral surgery, I am familiar with the problems of the oral surgeon when he is asked to prepare a mouth for dentures which someone else is to construct. In the past fifty or sixty years, many ideas have been submitted for this treatment of the mouth. Many have contributed to the development of these ideas. Dr. Kazanjian, of Harvard, says:

Fig. 3.—Excessive and undercut tuberosities; also small bony tumor in palate.

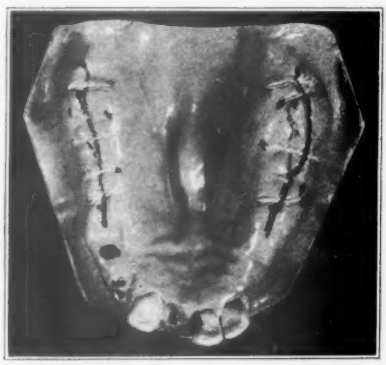

Fig. 4.—Immediately after the reduction of the tuberosities.

> The surgical treatment of mouth conditions which offer mechanical difficulties preventing the successful adjustment of artificial dentures is a comparatively new field, the possibilities of which are just beginning to be appreciated. It should be approached cautiously as otherwise irreparable damage is likely to result. Yet the successes which have been achieved in this field lead us to view it with expectation, and if we proceed carefully in its development, much good can be accomplished.

Dr. Kazanjian is about the only one of

a host of workers who has made an attempt to clarify the treatment.

So much has been said about mouth preparation that the average dentist is confused with respect to the meaning of adequate preparation of the mouth for dentures. It has caused a great many practitioners to become fearful of the consequences. As a result, many of our patients still suffer from wearing ill-fitting dentures, owing to lack of mouth preparation. Dentists will spend many hours in "adjustments," trimming, relieving the denture and applying the prime principle of medicine and dentistry, the "art" of convincing the patient that what has been done is the best that can be done. Notwithstanding, most mouth preparation procedures now are considered minor oral surgery and can be performed successfully by the general practitioner who is capable of removing teeth.

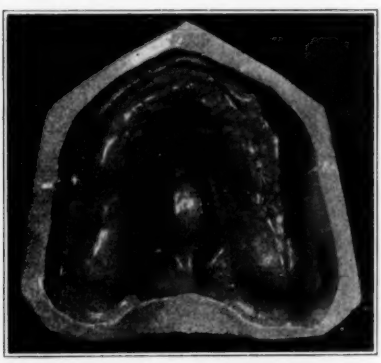

Fig. 5.—Case ready for the reception of denture.

Sufficient observations have been made by others to form a basis for classification of mouths that require surgical correction before efficient dentures can be inserted. As a general classification, then, we have mouths showing (1) bony deformities and (2) soft tissue abnormalities.

Deformities of the bone are: a rough, irregular and overhanging process, after extraction of teeth; enlarged tuberosities; a protruding maxillary process; a high and undercut lower anterior ridge, and exostosis.

The soft tissue abnormalities are: a low frenum attachment; the so-called low muscle attachment; redundancy of tissue, and fibromas.

The mere mention of these conditions brings to my mind a picture of the struggles and the memory of headaches following my attempts at denture construction without surgical correction.

Many of the foregoing conditions can be eliminated at the time the teeth are extracted. I shall not go into that discussion beyond mentioning the fact that the dentist, in removing a tooth or a number of teeth, should prepare that portion of the ridge by eliminating undercuts and sharp buccal margins. However, too many of our patients still come to us, having had all their teeth removed, but presenting the abnormalities mentioned. In these cases, added surgical procedure is indicated.

We are all familiar with the sharp and irregular buccal margin. The teeth have been out from two weeks to a month or more and we know from experience that it will take a long time for Nature to correct the deformity. We also know from sad experience the results of attempting to build dentures over those ridges. Surgical interference seems to be the only sound procedure and the operation is very simple.

TECHNIC

Under local anesthesia, an incision is made along the crest of the ridge from tuberosity to tuberosity. All tissues are carefully elevated on the buccal and labial aspects. The palatine portion of the soft tissue is raised slightly to permit easy suturing. The buccal and labial tissues are sufficiently elevated to expose the bony process. Excessive bone is removed with a rongeur and smoothed with a file. Then the flap is replaced, and the ridge tested for undercuts and roughness. If there is

an undercut, the flap is raised and the parts are corrected. It may be found at this point that the flap is too long. If the flap is only 2 or 3 mm. too long, it should not be cut away. The cut surface is approximated and sutured. After the wound is completely sutured, the mucobuccal fold is raised with the index finger to take up the slack in the flap. This raises the muscle attachments and allows for a greater vestibule.

The enlarged tuberosity is a common malformation of the ridge. I do not know that any one has assigned a cause for its presence. It is found in mouths in which the second or third molars have been standing alone for some years and perhaps it has developed as a defense mechanism against abnormal pressures. It is also encountered in mouths in which the opposing lower teeth have been removed and the upper second or third molars have been allowed to drift downward.

Surgical correction of the enlarged tuberosity is not difficult. A common fault among students is making the exposure too small. Under local anesthesia, a crescent-shaped incision is made on the ridge, as far distally as necessary and also as far anteriorly as is necessary to make an adequate exposure. With a periosteal elevator or a wide chisel, the mucoperiosteum is raised and the tuberosity is exposed. The soft tissues should be elevated sufficiently to expose the whole part to be removed.

As in all surgical procedures, no one instrument is the universal choice. The chisel and mallet, the surgical bur, the rongeur and files have all been used successfully. I prefer the rongeur because it removes the bone quickly, is easily controlled and does not jar the patient. The bone file is then used to smooth the roughened parts. The surgical bur is extremely efficient in the hands of the operator who possesses unusual skill.

The excess osseous structure is removed, a smooth well-rounded ridge without undercuts remaining. The flap is replaced and excess soft tissue is cut away to allow the flaps to approximate. The tissues are then sutured with either catgut or silk.

We are asked by our patients to construct dentures for mouths with a marked protrusion of the labial maxillary process. This usually is the result of Class II, Division 1, malocclusion, which might have been eliminated had adequate orthodontic treatment been possible. It is most difficult to construct successful dentures in these cases. Attempts have been made to overcome the difficulty by eliminating the labial portion of the denture and "butting" the teeth. This, I think, was the forerunner of our present roofless and rimless denture. On the whole, results have not been satisfactory without reduction of the protrusion by surgical means, to permit construction of an efficient denture.

A vertical incision from the crest of the ridge to the mucobuccal fold in the bicuspid region is made on both sides. Another incision is now made on the crest of the ridge joining the two vertical incisions. The soft tissues are carefully elevated, all the labial bony process thus being exposed. The amount of reduction to be made depends, of course, on the individual case. The operator is required to use judgment in determining the possibilities. Sufficient bone must be removed to permit placing a denture that will not distort the facial contour. When the bone has been removed and smoothed, the flap is replaced. The flap is trimmed to fit by removing a v-shaped portion at the bicuspid region and enough from the crest portion to approximate at the line of suture, and is sutured to place.

We have found that the last group of teeth to be lost are the lower anterior. The ridges posterior to the teeth, in a great many cases, have been absorbed to a marked degree, leaving the cuspid-to-cuspid area quite prominent. After removing the teeth, we find the anterior portion of the ridge several millimeters higher than the distal. We are tempted to leave this bony structure as high as possible, believing that we are being conserva-

tive, a false assumption, since, if we build a denture over a ridge of that kind, we find that in a few months this portion of the ridge is resorbed to a level with the distal part of the ridge. In the meantime, the patient has had a miserable time, and the dentist has had to make many adjustments. We should prepare this portion of the ridge to correspond with the posterior segment.

For this particular operation, I prefer mandibular block anesthesia on both the right and the left side. This gives positive, profound anesthesia and permits the necessary incision without added injections. The teeth are removed in the usual manner. An incision is then made distally along the crest of the ridge for one-quarter to one-half inch and the mucoperiosteum is separated from the process. This exposure is extensive enough to reveal the part of the ridge that has been resorbed and covered with dense bone. With this as a guide, the anterior portion is contoured. The mucoperiosteum is replaced and checked for undercuts. If the bony ridge is satisfactory, the excess soft tissue is trimmed off with scissors and sutured to place.

BONY TUMORS

Another abnormality found in the mouth which interferes with successful denture construction is the bony tumor springing from the surface of the bone. It is most frequently found on the internal surface of the mandible along the attachment of the mylohyoid, geniohyoid and genioglossus muscles; also quite frequently in the palate along this midline. The treatment of an exostosis in the mandible is simple. Under local anesthesia, an incision is made directly over the protuberance. With a suitable periosteal elevator, the soft tissues are elevated to expose the bony tumor. With a small sharp chisel, the growth is removed and, if necessary, smoothed with a file. The flap is trimmed to fit and sutured. Torus palatinus, or bulging of the palate, presents a slightly different picture, varying in size from a small definite tumor to a diffuse area of the palate. The small well-defined tumor may be removed quite easily by merely making an incision through the soft tissues covering the growth and removing it with a rongeur.

As the operation on the more diffuse tumor involves considerable risk, it should be performed only by skilled, experienced men possessing a detailed knowledge of the anatomy involved. The danger of perforating the palate is great, and the treatment of a perforated palate is difficult.

RELIEVING THE FRENUM ATTACHMENT

The most frequent soft tissue abnormality, as far as denture service is concerned, is the superior frenum. Many good dentures have been ruined because the frenum was attached too low on the ridge and instead of changing the frenum attachment an attempt was made to carve space for it in the denture. The result is an ill-fitting denture.

The treatment of this condition is not difficult. Under local anesthesia, a small incision is made at the base of the frenum attachment. The frenum is forced upward with a sterile sponge, when it will pull away from the ridge, a diamond-shaped wound remaining. The triangular portion on the lip is now sutured together, and the ridge portion is allowed to remain as it is. The lip will have a continuous mucous membrane surface and will not become reattached. This very simple, but effective operation takes but a few minutes.

The lack of a sufficient vestibule has been a serious problem in denture construction. Much has been written regarding the treatment of the low muscle attachment. The causes for a reduced vestibule may be: 1. Developmental malattachment of muscle bands, especially in the upper and lower bicuspid regions. 2. A difficult extraction during which the buccal or labial plate was removed and the soft tissues torn and not corrected.

3. Destruction of the alveolar process by disease, such as pyorrhea. 4. Lack of development of the ridges, as in some cases of cleft-palate.

The treatment for an insufficient vestibule, or the so-called low muscle attachment, is similar to raising the superior frenum attachment. Under local anesthesia, an incision is made through the mucous membrane at its attachment to the ridge. The incision must not sever the periosteum because denuded bone will not live; therefore, the incision is made only through the mucous membrane. With a sterile sponge, the mucous membrane and the submucous tissues are forced upward and away from the periosteum. The result will be a good-sized flap.

The most difficult part of this operation is the suturing. We have been using a double 00 catgut suture and a small half-rounded needle. The difficulty arises in suturing the loose buccal flap to the periosteum as high as possible.

The raw surface is left uncovered and allowed to granulate. In two or three weeks, the area is covered by mucous membrane.

In order to overcome the difficulty of this method of suturing, dentists have resorted to a variety of treatments, the last of which was reported a few months ago, consisting of using sterile carpet tacks, forced into the maxilla and covered by a bulk of cementum substance to form a barrier against reattachment.

Redundant soft tissue is usually found in the anterior region of both the upper and the lower jaw, more frequently in the upper jaw. The cause in most cases is traumatic occlusion and ill-fitting dentures—traumatic occlusion especially in mouths where the natural lower anterior teeth are present, but no posterior teeth either natural or artificial. The ridge presents at least two clinical pictures: one in which only the ridge is soft and movable, the other in which, in addition to the jelly-like ridge, there is a piling up of flabby tissue on the labial surface extending beyond the periphery of the denture.

The treatment is, first, to ask the patient not to wear the denture for a period of two weeks. Many ridges become firm when the source of irritation is removed. If the conditions persist, surgical interference becomes necessary. Under local anesthesia, a wedge-shaped piece of tissue is removed from the crest of the ridge from cuspid to cuspid, and the cut surfaces are sutured to form a solid, well-rounded ridge.

In addition to the abnormalities which directly affect the construction of an efficient denture, fibroma of the tongue, cheek or lip is occasionally encountered. It is important that the patient's attention be called to these conditions before the dentures are placed. If the growth is located in such a place that the dentures may irritate, it should be removed.

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THE JOURNAL *of the* AMERICAN DENTAL ASSOCIATION *and* THE DENTAL COSMOS*

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*In deference to the wish of the dental profession to control its literature, *The Dental Cosmos*, founded in 1859, was transferred by the publishers as a gift to the American Dental Association, January 1937.

Editorial Department

A FORTUNATE BLUNDER

AT the Atlantic City Session of the American Dental Association in July, a paper was read entitled "Building a Social Security Program." It was by a man who is not a dentist, but who was announced as "Chairman of the Social Security Board."

Frankly, when this paper was turned in for publication, it presented something of a problem. It advocated measures that were in direct contravention to the principles long since laid down and announced by our Association, notably by resolutions passed as early as 1934. At that time, we took an emphatic stand in opposition to all forms of health insurance, panel dentistry and other visionary and irrational ideas that we felt certain were not for the best interests of either the profession or the people. Such policies were voted inimical to our American ideals of life.

Since that time, we have not receded from this position, and therefore when this paper advocating health insurance, etc., was received for pub-

lication, we were in a dilemma. There seemed no recourse except to run the paper in our official publication, even in the face of our opposition to the ideas therein advanced. As an act of plain courtesy to a guest of our organization, we felt it incumbent on us to give the paper space, and we had accordingly listed it for publication in the October issue of THE JOURNAL.

But something happened. What seemed to us a fortunate blunder occurred. To our astonishment, we found that the paper had been released to other publications without our knowledge, and it was in fact in circulation in another periodical as early as August. This, of course, at once precluded using the paper in the official organ of the Association. We have always had a standing rule not to reproduce material that has already appeared in print.

The question, of course, arises: By virtue of what authority was this paper released? It is inconceivable that some one other than the author had the temerity to appropriate the manuscript and offer it for publication. If this was done, the author of the paper is entitled to redress. If the author released the paper on his own initiative, he is plainly not aware of the fact that the moment he read his paper at Atlantic City, it automatically became the property of the American Dental Association and was no longer his to dispose of.

But to return to the subject of the paper in question: It is the farthest thing from our intent to "dabble in politics," and if the incident just cited had not occurred, we would never have mentioned the subject. Our official publication has in every way possible sought to avoid political controversy. We have deemed it our duty to confine our editorial policies to a consideration of the strictly scientific and professional phases of dental practice. This has always seemed to us our proper course. But if for any reason we had been tempted to give expression to our views on the current social issues of the hour, our sole observation would have been to the effect that there was only one thing about which we were certain, and that is that no man living today can with assurance predict the outcome of all the social and economic unrest of our times. Just one thing is evident, and that is that the various and vociferous doctors of our social order are apparently as much at sea as the humblest and most unthinking man of the street. No one seems to know whither we are drifting. Most of the theories suggested by these same so-called doctors are found on analysis to be as wide of the mark as the tiltings of a Don Quixote, and as devoid of practical benefit.

Our Association has repeatedly gone on record as to our position on

such matters, yet in the face of this we are constantly being told by the Social Security enthusiasts that whether we like it or not these revolutionary policies are going to be forced on us and that we had better make a virtue of necessity and fall in line. Well, maybe, and again, maybe not. It is, of course, conceivable that the forces of revolution and imbalance may become sufficiently powerful to stampede us into acquiescence, but it might as well be known at the outset that we do not propose to take it sitting down. And we are not so very sure that we are going to take it at all. Sanity and common sense may prevail after all despite certain of these lugubrious predictions.

So far as the policies of the profession are concerned, it is logical to assume that we know with greater assurance what is for the best interests of the people in matters of health service than do the politicians, who manifestly know nothing at all of such matters. Pity the day when the destinies of our profession are in any way dominated by men who are totally ignorant of the people's needs in this respect.

The sensible and level-headed members of the profession and of society at large have from the very beginning been committed to the principle that "as ye sow so also shall ye reap," but certain of our modern propagandists seem to subscribe to the doctrine that you can reap without sowing at all. Something for nothing—something for nothing, seems to be the shibboleth of the hour and in every way this is demoralizing and enervating.

One of the most disintegrating agencies in our whole social order has been the operation of the various relief measures, and this is only one manifestation of community aid to the individual. The history of this activity should be lesson enough on the practice of indiscriminate giving. A manifest emergency was used as the entering wedge to a long and would-be permanent system of demoralizing and debasing paternalism. Some of the ramifications of certain of our relief agencies have smelled to high heaven, and the odor has not been pleasant to the nostrils of honest men and women. An analysis will show how venal some of these agencies have been, but it is enough to say that the situation has been notorious and intolerable.

Lest we be charged with inhumanity to man, we wish to make it clear that we are by no means opposed to every and all kinds of philanthropic aid to the needy. Quite the contrary. We recognize the crying need, and we know that something must be done. Two classes of society in particular appeal to us as calling for succor, the little children of the land and the aged and infirm. To these, our hearts go out in unceasing sym-

pathy; but the moment an able bodied man reaches out the palm and accepts something for nothing, that moment a moral disintegration begins that is the inevitable forerunner of defeatism and pauperism. It is common knowledge that the operation of relief has done more to break down the morale of the people than anything that has occurred in modern times. In our current issue will be found a paper read at the midwinter meeting of the Chicago Dental Society by Morris Fishbein, M.D., editor of *The Journal of the American Medical Association.* The subject is "State Medicine and Social Security," and we commend this paper to the attention of all of our readers as an able document on the subject.

The lavish and often ill-advised expenditures of some of our governmental agencies have become so notorious that every taxpayer has a right to ask who pays the fiddler. On the cover of the *West Virginia Dental Journal* for July 1937 may be found this wise and pertinent remark:

"What is wanted to keep men full of vitality is opportunity, not security. Security is merely a refuge from fear; opportunity is the source of hope."

And it may be added with equal emphasis that opportunity is created more by the desire and willingness of men to work than by any kind of paternalism or philanthropic coddling.

"DENTAL HEALTH FOR AMERICAN YOUTH!"

WHAT more praiseworthy purpose could be proclaimed as the aim of dentistry than that embodied in the slogan which our President, Dr. C. Willard Camalier, has adopted as the theme of the American Dental Association's activities during his administration?

At a stage in the development of the political, civic, industrial and social life of the nation when we have been impelled to a broader conception of our obligation to future generations, the American Dental Association can certainly do no better than to direct its energies toward the conservation of the dental health of the youth of the country, which experience has proved is an economic health factor in community life that cannot be ignored.

Early in the present century, after many years, in fact after most of the professional life of dentistry had been devoted to the perfection of

the mechanical aspects of mouth restorations, the profession awakened to a realization of the fact that there is a definite and vital biologic relation of mouth health to the health of the body as a whole; with the result that we began to give more serious attention to the development of dental practice from the standpoint of its relation to bodily health.

One of the first reactions of the dental profession to this newer conception of the function of dentistry was the inauguration of a movement to educate the public and the medical profession to the desirability of mouth health as a necessary ancillary to general bodily health.

In these educational efforts, however, we were immediately confronted with the necessity for actual and comprehensive clinical data that would support our claims. In the course of time, we had convinced ourselves that mouth health was a definite and positive essential to bodily health, but we did not have sufficient clinical data to prove our case to the skeptical medical mind, nor to the public.

Thus we were faced with the desirability of a change in, or rather a broadening of the scope of, dental practice and the necessity of accumulating clinical data to confirm our belief. The skeptical were not confined to the medical profession—they were in our own profession—which made the problem more serious, not to say difficult. However, with a full realization of the stupendousness of the task, but also fully convinced of the righteousness of the cause, Dr. W. G. Ebersole, of Cleveland, inaugurated a series of experiments in the care of the mouth and teeth directed toward preventing or controlling the conditions responsible for tooth disease, mainly dental caries, that were destined to revolutionize our conception of the purposes and objectives of dentistry, and also to furnish the factual data that were to convince the medical profession and the public that a healthy mouth is a necessary corollary to a healthy body.

These experiments were conducted upon school children of Cleveland and constituted what may be considered the first scientifically organized effort toward prevention of dental disease—an ideal that has been embodied in the major objective of the organized dental profession through our President, Dr. C. Willard Camalier, as the working theme under his directive administration for the present year.

These experiments also proved that dental disease was responsible for an enormous percentage of absences through sickness, which led to repetition of courses, thus increasing materially the cost of education of the children, to say nothing of the toll it imposed upon their future health. And, too, the benefits to these children in improved morale leading

to stimulation of pride in scholastic attainment were inestimable.

It is quite true that we are apparently far from the attainment of prevention in the true sense of the word, and we shall probably be far from it until the question of the etiology of dental caries has been fully solved. We have, however, an approach to this ideal that is intensely practical and one that is most effective in its results; and that is to begin our reparative control efforts as early as possible in the life of the youth. The main promise of such a program as our President is sponsoring is that it begins with the youth—the age at which the individual is not only most susceptible to dental disease but the age at which he is most receptive to the health lessons which the dental profession is endeavoring to teach.

We repeat: No more praiseworthy objective could be sponsored than that of improving the dental health of the youth of the nation, and it is but the duty of each member of our organization to enter wholeheartedly into the accomplishment of the high purpose toward which our President is aiming as partial fulfilment of the health obligation that we owe to the public.

In another section of the present issue, we are publishing a message from President Camalier in which he outlines quite precisely the ways and means by which every member of organized dentistry can be of help to him and his cause during the year's campaign for

"Dental Health for American Youth!"

L. P. A.

A NEW MAGAZINE

We welcome into the journalistic field the *Archives of Clinical Oral Pathology,* a magazine published quarterly by the New York Institute of Clinical Oral Pathology, New York City. The *Archives* is to be devoted primarily to the advancement of the study of pathology, diagnosis and treatment of diseases of the oral cavity through publication of material emanating from the New York Institute of Clinical Oral Pathology.

Two issues have now been published, and we wish to compliment the editor, Dr. Lester R. Cahn, and the sponsors on the result. Judging by the first efforts, the *Archives* is destined to be an eloquent mouth-piece of a group whose laudable purpose is to shed light on the interrelated problems of oral and general pathology.

The subscription price of the *Archives* is $5 a year and the subscription address is 30 Rockefeller Plaza, New York City.

OBITUARIES

DR. H. HERBERT JOHNSON

HENRY HERBERT JOHNSON, D.D.S., F.A.C.D., died, at his home in Crescent, Ga., Sunday, May 23, 1937, in his seventy-sixth year. Dr. Johnson was born near Elko, Houston County, Georgia, November 11, 1861; son of Needham Thomas and Sarah Holmes Johnson. He was educated in the public schools of Houston County and the Hawkinsville High School. He graduated from the Baltimore College of Dental Surgery in 1886, with the degree of D.D.S. and was a Fellow of American College of Dentists.

Dr. Johnson was professor of prosthetic dentistry, porcelain and metallurgy in the Southern Dental College of Atlanta from 1898 to 1918. He was a member of the Georgia State Board of Dental Examiners from 1893 to 1896, and was reappointed by Governor Dorsey in 1918 and by Governor Walker in 1924; an honorary member of the South Carolina, Alabama, Mississippi, and North Carolina State Dental Societies; a member of the Psi Omega Dental Fraternity; a Knight Templar and a Shriner. He was appointed a member of the Medical Board of the Macon (Ga.) Hospital Association in 1906, and was one of the first, if not the first, to receive this recognition from the medical profession in the South.

He was President of the Southern Branch of the National Dental Association in 1901-1902; a member of the American Dental Association, the Committee on Conference of the State of Georgia and the Committee on Essays of the World's Dental Congress in 1893, and Chairman of the Committee on State and Local Organization for the State of Georgia of the Fourth International Dental Congress in 1904.

The degree of Honorable Fellow was conferred on him by the Georgia State Dental Society in 1912.

Dr. Johnson was a constant contributor to current dental literature, and for several years was editor of the *Southern Dental Journal.*

Dr. Johnson was one of the most beloved and honored members of the dental profession and was known everywhere for his kind and gentle spirit and sincere love for the profession which he had chosen for his own. He was a firm believer in the tenet that each one of us is bound to make the circle in which we live better and happier, and that out of that small circle the wisest good may flow. He lived as if he had fixed in his mind the thought that out of a single deed or act there might come something which would influence the whole commonwealth or the whole world. His kind heart was as a fountain of gladness, making everything in its vicinity freshen into smiles.

Dr. Johnson is survived by his wife and two sons, Prof. H. Herbert Johnson, Jr., of Columbia University, and Mr. Wheeler Johnson, of the *Washington Post,* Washington, D. C.

S. W. F.

DR. W. J. BRADY

WILLIAM J. BRADY, D.D.S., Kansas City, Mo., nationally known as an orthodontist and dental educator, died August 17, at the St. Joseph hospital; aged seventy-five. He had practiced in Kansas City nearly forty years, and had been actively engaged in teaching and research for fifty years.

Dr. Brady was born in 1862 near Aledo, Ill. After his education in the district schools, he entered the dental department of the University of Iowa, where he was

graduated in 1886 as valedictorian of his class.

Dr. Brady from and even before his entrance into the dental profession showed a definite predilection for teaching. He taught a year at the American College of Dental Surgery, Chicago, which later was merged into what is now the Northwestern University Dental School. The next year he was a member of the faculty at the Missouri Dental College. From 1893 to 1899, he was professor of several subjects at the Western Dental College. He then served seven years on the faculty of the University of Iowa. Resigning in 1906, he returned to Kansas City.

He organized the International School of Orthodontia in Kansas City, and taught the first class of ten dentists, who came from eight states. Since 1915, he had been acting dean of this postgraduate dental school.

In 1917, he was an authorized examiner of dental applicants for service in the World War. He was President of the Kansas City Dental Society in 1918.

The widow, two sons, a sister and a brother survive.

ASSOCIATION ACTIVITIES

NATIONAL BOARD OF DENTAL EXAMINERS

A CHANGE IN THE REQUIREMENTS OF THE NATIONAL BOARD

FOR several years, the idea of holding a practical examination, to be known as Part III, has been under consideration by the National Board of Dental Examiners. Finally, in Atlantic City, at the annual meeting of the Board, it was voted to eliminate the practical examination as a requirement for a certificate of qualification. The following resolution was adopted:

Believing that the practical examination of a candidate should properly be reserved for the respective state examining boards, the National Board of Dental Examiners hereby eliminates Part III from its program and limits its examinations to Parts I and II, which are those covering theoretical examinations only. And be it further resolved that the National Board of Dental Examiners amends its rules and regulations and circular of information to effect the above-stated objective.

With this action, the National Board removed one of the contentious factors in its progress. It will continue to hold the theoretical examinations in the fundamental sciences and specialized dental sciences leading to a "certificate of qualification," which is awarded as evidence of successful completion of the examinations in the theory of the science of dentistry.

At the last meeting of the House of Delegates of the American Dental Association, another important change in the National Board was brought about by an amendment to the Administrative By-Laws which made the Surgeons General of the Army, Navy and Public Health Service active members of the Board rather than ex officio.

RESEARCH COMMISSION

CERTIFIED WROUGHT GOLD WIRE ALLOYS, A.D.A. SPECIFICATION NO. 7[1]

SAMPLES of all wrought gold wire alloys certified to the Research Commission of the American Dental Association by the various manufacturers were procured in the open market by the Research Commission and tested by the American Dental Association Research Associates at the National Bureau of Standards. The following list of wrought gold wire alloys was found to comply with American Dental Association Specification No. 7.

Certified alloys which did not comply are omitted from this list.

SECOND SURVEY OF WROUGHT GOLD WIRE ALLOYS
(September 4, 1937)

Alloy	Manufacturer or Distributor
Aderer No. 1	Julius Aderer, Inc.
Aderer No. 3	Julius Aderer, Inc.
Aderer No. 4	Julius Aderer, Inc.
Aderer 20 Clasp	Julius Aderer, Inc.
Baker Q. A.	Baker and Co., Inc.
Deepep Hard	Thomas J. Dee & Company
High Fusing Clasp	Goldsmith Bros. Smelting & Refining Co.
Jelenko No. 3 Clasp	J. F. Jelenko & Co., Inc.
Jelenko Super	J. F. Jelenko & Co., Inc.
Medium Clasp	Goldsmith Bros. Smelting & Refining Co.
Ney-Oro Elastic No. 2	The J. M. Ney Company
Ney-Oro Elastic No. 4	The J. M. Ney Company
Neydium 9	The J. M. Ney Company
Regular Clasp	Goldsmith Bros. Smelting & Refining Co.
Sypco No. 3	Spyco Smelting & Refining Company
Stern 2657	I. Stern & Company, Inc.

1. PAFFENBARGER, G. C.; SWEENEY, W. T., and ISAACS, AARON: Wrought Gold Wire Alloys. Physical Properties and Specification. J.A.D.A., 19:2061, December 1932.

REPORT OF THE RESEARCH COMMISSION

FISCAL YEAR—JULY 1, 1936 TO JUNE 30, 1937

To the President of the American Dental Association, Members of the Board of Trustees and the House of Delegates:

THE following report presents the general activities of the Research Commission of the American Dental Association during the year July 1, 1936 to June 30, 1937.

At the annual meeting of the American Dental Association held in San Francisco, Calif., July 13-17, 1936, an appropriation in the amount of $13,000 was given to the Research Commission to cover grants and administrative expenses for the fiscal year beginning July 1, 1936 and ending June 30, 1937. In addition, we have a specific fund of $750 allocated

to the Research Commission by the National Society of Denture Prosthetists and the American Full Denture Society to be used for the purchase, study and investigation of denture base materials at the National Bureau of Standards.

No additional requests for funds were made nor additional grants received during the year.

The accompanying table shows how this appropriation was expended.

Two meetings of the Executive Board and one meeting of the Research Commission were held at San Francisco. The final meeting of the Commission was not held in San Francisco owing to the fact that we did not have a quorum in attendance. This necessitated the calling of a special meeting of the Executive Board, which was held in Chicago, Ill., during the Chicago Dental Society Mid-winter Meeting. In addition, the Chairman and Secretary of the Research Commission held two conferences during the fiscal year. These meetings were all held for the purpose of discussing the work of the Research Commission at the National Bureau of Standards, as well as the annual report and other business coming before the Commission during the fiscal year.

GRANT NO. 1—SPECIAL ADVISORY COMMITTEE ON DENTAL CARIES

The Board of Trustees of the American Dental Association approved a grant of $800 to the Special Advisory Committee on Dental Caries with the stipulation that $600 of this amount be given to the International Association of Dental Research to assist in the publication of its journal.

This appropriation to the International Association of Dental Research was for one year and with the understanding that the Board of Trustees would appoint an assistant editor to function on the board of the research journal.

No report has been received by the Research Commission this year from the International Association of Dental Research. The balance of $200 of this grant has been left unexpended since it was not sufficient to begin the work of compiling a bibliography on dental caries.

GRANT NO. 2—AMERICAN DENTAL ASSOCIATION RESEARCH FELLOWSHIP, NATIONAL BUREAU OF STANDARDS, WASHINGTON, D. C.

The cooperative research program on dental materials at the National Bureau of Standards has been particularly active this year.

The Research Commission believes that this study of materials used in restorative dentistry under the auspices of this fellowship is a necessary and important activity of the American Dental Association. The Research Commission is encouraged by the numerous inquiries received and the ever increasing number of interested members of our profession and dental manufacturers visiting the Bureau seeking and receiving information. The profession and the manufacturers share this belief and are actively assisting the Commission in accomplish-

1. Special Advisory Committee on Dental Caries ($600 of this amount was a specific stipulation by the Board of Trustees in support of *The Journal of Dental Research*)	$ 800
2. American Dental Association Research Fellowship at the National Bureau of Standards	10,450
3. University of Louisville	750
4. College of Physicians and Surgeons	250
5. Executive Board	500
6. Secretary's Office	250
Total	$13,000

ing its program of standardizing and improving dental materials and their manipulation.

This fiscal year the Federal appropriation for this work was approximately $4,500. The Government also furnishes office and laboratory space and permits the use of its scientific instruments. Wilmer Souder (physicist) and I. C. Schoonover (chemist) of the Dental Research Division and all members of the Bureau Staff are available for consultation.

The Research Commission employs three full time research associates: George C. Paffenbarger (dentist), W. T. Sweeney (physicist) and J. R. Beall (mechanical engineer). These men are stationed at the Bureau and are subject to the same regulations as are members of the Bureau's staff.

In the Scientific and Health Exhibit Sections at this Atlantic City meeting, the Research Fellowship at the National Bureau of Standards presents the following exhibit.

"Investigation of Dental Restorative Materials"

1. Certified Materials.
2. Silicate Cements.
3. Denture Base Materials.

Please consult your "Official Program" as to time and place of presentations of papers by our research associates at the National Bureau of Standards.

In the future, under the heading of "Research Commission," a revised list of certified materials will be published quarterly in THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION.

A personal report of our senior research associate at the National Bureau of Standards follows.

OUTLINE OF THE COOPERATIVE DENTAL RESEARCH BETWEEN THE NATIONAL BUREAU OF STANDARDS AND THE AMERICAN DENTAL ASSOCIATION (1936-1937)

The cooperative research work on dental materials for the fiscal year 1936-1937 includes: (1) testing of silicate cements, (2) testing of denture base materials (synthetic resins), (3) testing of certified materials, (4 revision of specifications, and (5) miscellaneous activities.

1. SILICATE CEMENTS

The investigation of the silicate cements was completed, a specification was formulated and a report of the three-year study is now ready for publication.

A summary of this year's progress follows:

(a) Dimensional Change on Setting.—Measurements made on specimens comparable in size to oral restorations demonstrated that in some cements the size of the specimen had a very pronounced influence on the dimensional change on setting. The measurements were made on a new adjustable interferometer which would accommodate a 2 mm. specimen. The time at which water came in contact with the specimen also had a great effect, and by varying this time, a shrinking cement could be made to expand, or an expanding cement could be made to shrink. All of the expanding cements were slow-setting ones. In order to repeat test results, it was necessary to control every detail involved in preparing test specimens because the silicate cements are extremely sensitive to changes in their environment. It is not practicable for the dentist to do this.

(b) Composition.—Chemical analysis of the liquids revealed they are aqueous solutions of phosphoric acid (H_3PO_4) containing zinc and usually aluminum salts. The liquids do not contain so much phosphoric acid as do the zinc phosphate cement liquids. The arsenic content was, in the case of the two liquids: 1 part in 200,000 parts (U.S.P. requirements are 1 part in 100,000 parts), and in another liquid, 1 part in 500,000. In all of the other liquids, there was much less.

(c) Darkening.—Some cements when

suspended in hydrogen sulfide (H_2S) gas darkened. Spectrographic analysis of the liquids indicated that there was some correlation between base metal impurities in the liquid and the tendency of the cement to darken.

(d) Opacity.—Measurements of the opacity of human tooth tissue and of the silicate cements (by determining the ratio of contrast between the apparent reflection of light from a specimen when it is placed upon first a black and then on a white background) were completed. When the same amount of light is reflected from the specimen, regardless of the backing, it is considered opaque. Human enamel was much less opaque than dentin. This is generally so, although several instances were noted where the enamel was more opaque than the dentin. Some cements were more opaque than dentin, while others were less opaque than enamel.

The darker shades of cement were more opaque than the lighter shades.

The opacity of a silicate cement at the end of one hour was much greater than at twenty-four hours. After twenty-four hours, there was a slight decrease in opacity with time, *i.e.*, the cement became more translucent.

(e) Method of Protecting Liquids from Deterioration.—To maintain the cement liquids at a constant composition even when they are exposed to air for long periods of time, a few drops of a light mineral oil were added to the liquids. The oil floats upon the surface of the liquid and forms a protective layer which prevents the evaporation of water from the liquid or the absorption of water from the air. In practical use, the dropper should be inserted beneath the oil film before any liquid is drawn into the dropper. In trial mixes, a small amount of oil did contaminate the liquid, but this did not seriously injure the physical properties. It is believed that some trial fillings should be placed in the mouth and their behavior observed over a period of several months because laboratory tests may not have detected some fault which will be discovered in clinical use.

Another method which is more cumbersome, yet mistake-proof, is to place the unstoppered bottle containing the cement liquid in a closed jar or container, in which the humidity is maintained at a value that is in equilibrium with the vapor pressure of the cement liquid. Then no water will leave or enter the cement liquid and its composition will be constant.

(f) Premature Exposure of a Cement to Water or Saliva.—The cements are not hydraulic, *i.e.*, they will not harden properly under water. If water comes in contact with them before the initial hardening has occurred, the cements will be irreparably damaged.

(g) Varying Powder-Liquid Ratio.—A thin consistency of mix produces a cement that has a slower setting time, a higher solubility and disintegration, a higher acidity, a larger shrinkage and a slightly lower compressive strength than a normal consistency of mix produces.

(h) Variation Among Batches of the Powder and the Liquid of the Same Cement.—Considerable variation among the batches of the same brand of powder were demonstrated by means of the consistency test. The liquids were often not uniform in composition from batch to batch because they lost or gained varying amounts of water when placed in an atmosphere held at a constant humidity.

(i) Tentative Specification.—A proposed tentative A.D.A. Specification No. 9 for Dental Silicate Cement was formulated and was submitted to dental schools, manufacturers of silicate cements and other interested parties for their criticisms and suggestions.

A report of the entire silicate cement investigation has been prepared and will be presented at the A.D.A. meeting in Atlantic City by Drs. Paffenbarger, Schoonover and Souder.

2. DENTURE BASE MATERIALS

Practically all of the time this year was devoted to investigating the phenol-formaldehyde and vinyl resins. Tests by which these materials can be defined were developed. These tests were used to detect differences among batches and differences caused by aging.

A. Vinyl Resin.—(a) Polymer distribution: In the vinyl resins, the distribution of polymers of different chain length or size was found to vary with batches. The relative distribution of the polymer sizes affects the physical properties of the material. Differences of polymer distribution were detected in resins obtained from dentures which had been satisfactory in service, and also from dentures which had been unsatisfactory, but no correlation was established between polymer distribution and success or failure of a denture made of vinyl resin. Vinyl resins were found to be chemically stable, even when heated until they darkened.

(b) Viscosity: The viscosity of solutions of the resin was obtained in order to determine the average molecular weight of the resin, because the average molecular weight is probably the best single index of its properties. That is, a resin with a very high molecular weight will be harder to press, but will have greater strength than the resin of lower molecular weight.

(c) Strain: The samples of resins were tested for strain by the use of polarized light, and also by heating to their softening temperature. All samples were strained, some more than others.

(d) Pressing characteristics: An instrument was designed and built for determining the relative pressing characteristics of these resins. The resins of high molecular weight required either higher pressures or temperatures, or both, to press to the same degree than did the lower molecular weight resins. When dentures and denture blanks were heated in boiling water, they tended to return to their original shape because the internal strains were released. Therefore, if a vinyl resin was washed in very hot water, some warpage might occur. Such variances were found among different samples of the same trade brand of material and contraindicate the general use of a single pressing technic.

It is believed that this instrument can be used in determining pressure and temperature conditions necessary for a satisfactory technic.

As previously reported, vinyl resins have many good physical properties, but because of the great number of denture failures, it seems feasible to consider the material as an experimental one until further improvements are made in the material or in the pressing technic.

B. Phenol-Formaldehyde Resins.—The investigation of phenol-formaldehyde resins was confined to work on three of the widely used trade brands.

(a) Chemistry: Quantitative chemical methods, based upon the solubility of the resin in acetone, were developed for determining the "shelf life," *i.e.*, changes in the material under different storage conditions, and for measuring the degree of curing. These methods are applicable to both the cured and the uncured resin, and can be used to determine (as subsequently correlated by mechanical tests) which cure will give the optimum physical properties.

(b) Shelf life: The "shelf life" of phenol-formaldehyde resins were investigated at 60° C., 0° C., room temperature, 37° C. and 72° C. Two resins stored at room temperature and at 37° C. were found to have appreciable "shelf life," *i.e.*, they were partially cured when stored at these temperatures. The resins held at 72° C. were cured to such an extent that they could not be pressed. Resins of this type should be stored at cool temperatures, approximately 0° C., to prevent premature curing.

(c) Curing time: The curing characteristics were found to vary with the

storage temperature. Resins stored at room temperature and above for long periods were in some cases overcured, or burned, differed in color and failed to fuse when cured at the temperature recommended by the producer.

(d) Color: Preliminary tests on color differences on resins were made on the chromaticity-difference colorimeter. This instrument seems to be satisfactory for observing color changes of small order in these resins.

The investigation of denture base materials was conducted by Dr. Schoonover and Mr. Sweeney.

3. TESTING OF CERTIFIED MATERIALS

The testing program of the fellowship during the past year has included surveys of the lists of certified products and tests of those products offered for certification by the manufacturers during the year. A summary of the testing follows:

(a) Seven amalgam alloys were offered for certification by the manufacturers, and were tested for compliance with A.D.A. Specification No. 1. Five of these were found to comply and have been added to the list of certified amalgams. Two alloys (or 28.5 per cent) failed to comply, and it was recommended that the certifications for these alloys be not accepted.

(b) One inlay casting investment was offered for certification, tested and found to comply. It was recommended that it be added to the list of certified investments.

(c) Two impression compounds were certified by the manufacturers, tested and found to comply, and were recommended for addition to the list of certified impression compounds.

(d) One inlay wax was certified, tested and found to comply. It was recommended that this wax be added to the list of certified inlay waxes. (The most recent lists of certified amalgam alloys, inlay casting investments, impression compounds and inlay casting waxes were published in the February issue of THE JOURNAL, pages 271, 272 and 273.)

(e) The survey of the certified casting golds was completed. At the inception of these tests, there were fifty-five alloys on the certified list. During the testing, four more were certified. Twelve alloys failed to comply with the specification requirements. Further, certification was withdrawn for twelve alloys (including some of those which failed). This reduced the list of those complying to thirty-seven alloys. Since the completion of these tests, twenty-five more alloys have been certified (including those twelve which were withdrawn and are now being certified under another name). Tests of five of the twenty-five newly certified alloys were completed. All five complied with the specification, and were recommended for addition to the list of certified inlay casting golds, which at present contains forty-two alloys. (See page 808 of the May, 1937 issue of THE JOURNAL.)

(f) At the beginning of the survey of the certified dental mercuries, there were thirteen on the list. During the tests one additional mercury was certified by its manufacturer. All mercuries were found to comply, and the present list of certified mercuries contains fourteen trade brands. (Page 1188, July 1937 issue of THE JOURNAL.)

(g) A survey of the wrought gold wire alloys was begun. There are fourteen alloys under test, twelve of which were on the list of certified products and two of which have been certified only recently by the manufacturer. These tests are nearing completion, as the physical properties have been determined on all alloys and the noble metal content remains to be determined.

Samples are being procured for surveys of both the certified zinc phosphate cements and the amalgam alloys to prevent delay when these surveys are started.

Tests also have been started on several products which have just recently been certified.

The testing of the certified materials has been conducted by Mr. John R. Beall. In case a product failed to comply, confirmatory tests were made by other workers before final rejection of the manufacturer's certificate was recommended.

4. REVISION OF THE SPECIFICATIONS

A proposed revision of A.D.A. Specification No. 8 for Dental Cementing Medium was sent to manufacturers of dental zinc phosphate cements, dental schools and members of the Research Commission for their comments. The essential changes proposed are: (1) deletion of the one-hour compressive strength requirement, (2) reduction of the maximum permissible film thickness from 50 to 40 microns, (3) reduction of the maximum permissible value for disintegration from 1.0 per cent to 0.3 per cent, (4) reduction of the maximum permissible value for arsenic content from 1 part of arsenic in 100,000 parts of cement to 1 part of arsenic in 500,000 parts of cement.

The revision will be submitted to the Research Commission for their further consideration at the meeting in Atlantic City.

5. MISCELLANEOUS ACTIVITIES

Approximately 122 persons visited the laboratory during the past year. Foreign visitors included among these were from Germany, Norway and England.

Dr. Paffenbarger presented the work of the laboratory on zinc phosphate cement at the IX International Dental Congress and visited research and testing laboratories in England, Austria, Germany and Sweden, where investigations of dental materials are being conducted. A written report of his observations was sent to the Executive Board in November.

Reports of the work were presented before the following societies: Columbus Dental Society (Ohio), Midwinter Meeting of the Chicago Dental Society, Five States Meeting, Annual Meeting of the American Dental Association in San Francisco, International Association for Dental Research, Maryland State Society, Delaware State Society, National Society of Denture Prosthetists, American Full Denture Society, Northwestern University, Georgetown University, and the IX International Dental Congress. It is estimated that about 1,300 dentists were present when the reports were given.

The following reports on the work were published during the year:

1. Sweeney, W. T., and Schoonover, I. C.: A Progress Report on Denture Base Material (1935). J.A.D.A., 23: 1498, August 1936.

2. Paffenbarger, G. C., and Souder, Wilmer: Physical Properties of Zinc Phosphate Cements. Proc. IX Internat. D. Congress, Vol. 1, p. 347.

3. Research Commission Report—List of Certified Products (1935-1936). J.A.D.A., 24:269, February 1937.

4. Research Commission Report—List of Certified Inlay Casting Golds. J.A.D.A., 24:808, May 1937.

5. Research Commission Report—List of Certified Dental Mercuries. J.A.D.A., 24:1188, July 1937.

Respectfully submitted,

GEORGE C. PAFFENBARGER,
Senior Research Associate.

GRANT NO. 3—UNIVERSITY OF LOUISVILLE SCHOOL OF DENTISTRY, LOUISVILLE, KY.

The Research Commission financially assisted this project in the amount of $750 for the year. This allocation was used for the purpose of aiding Dr. Theodore B. Beust in his research on biologic problems. This grant in the past has presented many excellent exhibits and again this year in the Scientific and Health Exhibit Section will exhibit "Tooth Replacement in the Barracuda Pike."

The following is a personal report of the studies carried on by Dr. Theodore B. Beust (Dr. John T. O'Rourke, advisor):

REPORT OF THE ACTIVITIES OF THEODORE B. BEUST, GRANTEE SCHOOL OF DENTISTRY, LOUISVILLE, KY. June 30, 1936 to July 1, 1937

1. American Dental Association Scientific Exhibit at San Francisco, July, 1936. Exhibit on Caries.

2. Research Commission Scientific Exhibit. Displayed with the A.D.A. Scientific Exhibit at San Francisco. "The Dentition of Sphyraena Barracuda."

3. Publication: "Contact Point Caries." Published in the *Journal of Dental Research,* **15**:453, December 1936.

4. Publication (in print): "Micrology of Gingival Inflammations." (To appear in an early issue of the *Journal of Dental Research.)*

5. Report: "Mechanisms of Tooth Change in Sphyraena Barracuda." Presented at the meeting of the International Association of Dental Research, at Baltimore, Md., March 1937.

6. Kentucky Academy of Science: "Discussion of the Tooth Root of the Teliost Fish Sargus Ovis." Louisville, Ky., May 1, 1937.

7. Nearing completion: "Genesis of the Periodontium." (To be read before the Research Section of the American Dental Association, Atlantic City, N. J., July 1937.)

Offices held: American Association of Dental Schools. Chairman: Section of Histology-Embryology at Baltimore, March 1937; Kentucky Academy of Science, vice-president, 1937-1938.

Problems under way: Contact point caries; various investigations in comparative odontology; some questions in mammalian embryology; further investigations in mouth micro-organisms.

Respectfully submitted,

THEODORE B. BEUST.

GRANT NO. 4—RESEARCH ON LOCAL ANESTHESIA SCHOOL OF DENTISTRY, COLLEGE OF PHYSICIANS AND SURGEONS SAN FRANCISCO, CALIF.

This project has been financially assisted in the amount of $250 by the Research Commission during the last fiscal year.

An exhibition of this study will be presented in the Scientific and Health Sections, "The Comparative Value of Various Vasoconstrictors in Local Anesthetic Solutions."

The following personal report is submitted by Dr. M. L. Tainter (Dr. A. R. McDowell, advisor).

PROGRESS REPORT, BY DR. M. L. TAINTER, COLLEGE OF PHYSICIANS AND SURGEONS, SAN FRANCISCO, CALIF.

The Research Commission allocated $250 for the partial support of this project for the year. These funds have been entirely expended for the materials, chemicals, animals and apparatus used for the studies. In fact, other sources of funds have had to be sought, since the total money available permitted only a part of the entire program to be carried forward.

During the year, the research studies under this grant have been made the basis of displays and exhibits at the American Dental Association meeting in San Francisco, at the California State Dental Meeting at San Jose and at the California State Medical Meeting at Del Monte. In addition, Dr. Tainter or Dr. Throndson, on invitation, has presented the results of these studies, with due reference to the Research Commission's indispensable rôle in financing them, before professional and scientific groups as indicated in the list below:

1. Pacific Coast Section, Society for Experimental Biology and Medicine, October 10. The Clinical Effectiveness of Procaine HCl as Compared with Procaine Borate.

2. Seattle District Dental Society,

Midwinter Clinics, January 16. Clinic on Local Anesthesia.

3. Pacific Coast Section, Society for Experimental Biology and Medicine, January 22. A Survey of the Available Topical Anesthetics Used in Dentistry.

4. San Francisco District Dental Society, March 1. Clinic on Local Anesthesia.

5. California State Dental Association, San Jose, April 14. The Value of Various Topical Anesthetics and the New Vasoconstrictors Being Used.

6. Anesthesia Section of the California State Medical Association, Del Monte, May 5. Alkaline and Acid Local Anesthetic Solutions and the Vasoconstrictors Being Used.

7. Pacific Coast Section, Society for Experimental Biology and Medicine, Berkeley, May 8. Irritation from the Sodium Bisulfite Used in Epinephrine Solutions as a Preservative.

The results of the studies are incomplete in many directions, but have progressed to the point where the publications listed below have been, or are being made, covering certain parts of them:

1. A Comparison of Procaine Hydrochloride and Procaine Borate (Borocaine) as Local Anesthetics. J.A.D.A., 24:376, March 1937.

2. Studies in Topical Anesthesia. II. Further Observations on the Efficacy of the More Common Local Anesthetics on the Gums and Oral Mucosae. J.A.D.A., to be published.

3. A Comparison of Procaine HCl and Procaine Borate (Borocaine) as Local Anesthetics. Proc. Internat. Ass'n D. Res., to be published.

4. The Comparative Value of Various Vasoconstrictors in Local Anesthetic Solutions. Proc. Internat. Ass'n D. Res., to be published.

5. Topical Anesthesia of the Mucous Membranes of the Mouth. Proc. Internat. Ass'n D. Res., to be published.

6. Local Irritation from Sodium Bisulfite as Preservative in Epinephrine Solutions. Proc. Soc. Exper. Biol. Med., to be published.

The research of the year has consisted of:

(1) A completion of the studies by the "blind-test" technic of the relative clinical value of procaine borate and procaine hydrochloride. In brief, the conclusions were that when the operators did not know which solution they were using, the observed differences between them became very small, inconstant and almost insignificant. It was suggested, from these findings, that the importance of p_H, buffering, alkaline solutions, etc., were greatly exaggerated as far as the actual clinical differences of the solutions were concerned.

(2) The survey of the available topical anesthetics. This was completed from the standpoint of their value for anesthetizing the oral mucosae in dental operative procedures. Nine control and twenty-two supposedly anesthetic solutions were tested by the blind test technic on over two thousand patients. It was found that from one-third to one-half the apparent value of these solutions was due to psychic influences, suggestion or imperfect sensitivity of the membranes. Alcohol was found to be largely, if not entirely responsible for the local necrosis or sloughs that these solutions sometimes cause, since use of over 30 per cent concentrations of alcohol were usually accompanied by these burns, and none occurred when water was the solvent. The most effective and desirable compounds from all standpoints seem to be butyn and benzocaine, since with these almost complete surface anesthesia could be obtained in most cases. The usefulness of the benzocaine was limited by the fact that alcohol was required to dissolve it. We have begun the search for other solvents which will be free of the caustic effects of the alcohol, and have found one at least which is not toxic to tissues and with which deeper and more profound anesthesia from benzocaine is secured. Studies

of the range of applicability of this solution are being continued with very encouraging results and will be submitted for publication shortly.

(3) Work on the relative value of epinephrine, cobefrin and neosynephrine when used as vasoconstrictors in dental local anesthetic solutions. For this study, Dr. Throndson spends full time in the oral surgery clinic analyzing and recording the results of each anesthetic injection made by the regular operators. The drugs are identified only by number so as to make this also a blind-test, and are frequently changed. About one-half the required number of data have so far been obtained, so that this part of the study needs to be carried on for another year, if we are to arrive at reliable conclusions. We are studying the speed of the anesthesia, duration, intensity, volume of solution required, amount of bleeding, local irritant effects, systemic reactions, etc., in an attempt to be able to say conclusively wherein these solutions differ from each other and wherein they do not. Since the operators or observers never know the solutions being used at any given time, personal bias is being completely avoided.

(4) Experiments with the vasoconstrictors. These have been amplified and extended by beginning the study of the drugs in experimental animals. Lack of funds has seriously hindered this part of the program, but enough has already been done to show that some of the claims for special preparations will not stand up on critical investigation. The toxicity and relative effects of these agents on blood pressure and respiration in animals have been incompletely studied, as has been the influence of the vasoconstrictor on the toxicity of the procaine used as the anesthetic. Considerably more work is needed to complete this part of the program and to extend it in certain vital directions.

(5) Study, begun and completed, as to the possibility that the sodium bisulfite which is present in many epinephrine and local anesthetic preparations was irritating and therefore deleterious. Apparently, this chemical has been added as a preservative to prevent the oxidation of the epinephrine, without any study of whether it would be irritating or not. Glass electrode measurements showed that bisulfite solutions of the strengths commonly used had p_H values as low as 2.12 and that these solutions irritated mucosae and subcutaneous tissues. The need for manufacturers to find a non-irritating substitute for the bisulfite was therefore pointed out on the basis of these observations.

The Chairman of the Research Commission discussed the research activities before several state and district dental meetings during the year. The following reports and papers have been published.

1. Program of the Research Commission at the National Bureau of Standards. J.A.D.A., 23:1312-1316, July 1936.
2. Dental Research and Its Value to the Public. J.A.D.A., 24:143-146, January 1937.
3. Report of the Research Commission of the American Dental Association. J.A.D.A., 24:269-281, February 1937.
4. Policies of the Research Commission of the American Dental Association. J.A.D.A., 24:640-643, April 1937.

COMPARATIVE FINANCIAL STATEMENT

The accompanying table shows the expenditures during the fiscal year 1936 and 1937.

On the basis of 40,000 members, each member of the American Dental Association contributed approximately 26 cents this year to the physical research at the National Bureau of Standards, 2.5 cents to aid the two biologic research problems, and less than 1.8 cents for executive and secretarial expenses. (The latter is unusually low in comparison with operating costs for similar activ-

ities.) The total cost for all our research work for the year is therefore approximately 30 cents per member.

RECOMMENDATIONS

GRANT NO. 1—SPECIAL ADVISORY COMMITTEE ON DENTAL CARIES

The Commission recommends that the American Dental Association provide sufficient funds so that this committee may proceed as planned, to compile a bibliography and to correlate all the known research on this most important subject.

GRANT NO. 2—AMERICAN DENTAL ASSOCIATION RESEARCH FELLOWSHIP, NATIONAL BUREAU OF STANDARDS

There is a necessity for the addition of another associate to the Bureau for the purpose of testing materials. With our present personnel, we cannot test the certified materials as frequently as is necessary for the protection of the profession. Without more frequent testing, the value of our previous expenditures in setting up specifications will be depreciated. The Commission recommends the addition of one more associate to the bureau staff.

GRANT NO. 3—UNIVERSITY OF LOUISVILLE

The Commission recommends the continuance of support and aid to this worthy project.

GRANT NO. 4—RESEARCH ON LOCAL ANESTHESIA, COLLEGE OF PHYSICIANS AND SURGEONS

Certain phases of local anesthetic experiments must be conducted by animal experimentation, since only by this means can certain data be secured which are not obtainable in human subjects. A more satisfactory development and earlier completion of this project would be of practical value to the profession.

It is recommended that this allocation be increased this forthcoming year to hasten the completion of this important and practical work for the knowledge and use of our members.

Again, the Research Commission wishes to stress the need for your consideration of the future policy in biological research.

	Grant for 1936-1937	Disbursed June 30, 1937	Unexpended Balance
1. American Dental Association Research Fellowship at the National Bureau of Standards	$10,450.00	$10,686.22	
2. University of Louisville	750.00	750.00	
3. Research on Local Anesthesia, College of Physicians and Surgeons	250.00	250.00	
4. Executive Board	500.00	500.00	
5. Secretary's office	250.00	250.00	
6. Special Advisory Committee	800.00	600.00	$200.00
Totals	$13,000.00	$13,036.22	$200.00

The present tendency of other research organizations is to favor the fellowship method of grants and to limit rather than withdraw grants-in-aid, believing that smaller institutions should continue to be recognized.

Since our arrangement at the National Bureau of Standards with reference to physical research has been so satisfactory, is it not logical to assume that a similar arrangement in the biologic field at the National Bureau of Research will prove equally satisfactory?

We must continue to put forth every effort to solve our biologic research problems. Respectfully submitted,

P. C. LOWERY, *Chairman.*

BUREAU OF PUBLIC RELATIONS

DENTAL HEALTH FOR AMERICAN YOUTH

By C. Willard Camalier, D.D.S., Washington, D. C.
President of the American Dental Association

REGARDLESS of the causes of dental decay, dentistry is charged with its cure, and its prevention.

Through evolutionary processes, society has built up within its ranks a professional group to care for its dental ills. Society has granted this group, known as the dental profession, certain rights and privileges by law. In return for these privileges, dentistry is obligated to fulfil the trust placed in it.

Dentistry has, during its short professional history, conscientiously fulfilled its obligation, in part, to society. During the past century, the dentists of America have labored long and diligently to improve technics, procedures and standards so that today the American people have access to the best operative dentistry in the world.

However, supplying the world's best operative dentistry is not in itself sufficient. The profession must now move forward and fulfil its entire obligation by supplying society with preventive measures that are on a par with or surpass their operative procedures.

Dentistry is a profession with great traditions; but we cannot be content with that knowledge. We must always keep in mind that we are a profession burdened with grave responsibilities. Our greatest responsibility now is not so much in improving our present high standard of operative and restorative dentistry, but in promoting and perfecting preventive procedures.

Fully appreciating dentistry's obligation to society in this respect, the American Dental Association has adopted, as its 1938 slogan, "Dental Health for American Youth."

It is not enough, however, to adopt a slogan. Action is more powerful than words. Action is what is needed at the present time—unified, coordinated, positive action on the part of the American Dental Association and its state and component societies.

Let us, this year, set in motion the wheels of a nation wide preventive machine that will eventually run so smoothly and efficiently that we can say to society, "We are fulfilling our obligation to you and warrant the trust that you have placed in us."

In all probability, future research will disclose that the origin and practical prevention of dental caries is not a dental problem. It is not at all unlikely that scientists will conclusively prove that this most prevalent disease is the result of some systemic imbalance. Once the etiology of dental caries is definitely proved, it may be that its prevention will no longer be dentistry's responsibility.

Until that time arrives, it is dentistry's duty to put into effect those practices and principles that we now know will greatly reduce the incidence and seriousness of this disease.

It is fitting, then, that the American Dental Association and its state and component societies and each of its 43,000

members focus attention this year on "Dental Health for American Youth."

The officers of the American Dental Association request the officers of the state and component dental societies to put into operation as many of the following suggestions as possible this year. If all these suggestions are carried out by all dental societies, 1938 will go down in history as the year in which the American Dental Association definitely embarked on a preventive program.

1. Adoption of the slogan: "Dental Health for American Youth." Place it on all society letter heads, especially on correspondence going to the public. Stamps bearing this slogan could be placed on all envelopes. Carry it on all dental journals and notices sent to individual dentists.

2. A national dental poster contest.

The A.D.A. is sponsoring as a feature of this year's program a nation-wide poster contest for 1938. This effort is to be consummated at the Annual Session in St. Louis, 1938. Every state and component society is urged to participate. Full particulars regarding this contest will be mailed to the presidents of all societies very soon.

3. Community discussions on the subject "How Can Dentistry Best Serve the Public?" One of the best methods of arousing community interest in preventive dentistry is to ask some of the leading citizens to discuss the problem. Full information regarding the best method of holding these discussions will soon be mailed to each society president.

4. Local radio broadcasts.

Dental societies should make more use of radio facilities. The state and many component societies should have an active radio committee and interesting and authentic material on preventive dentistry should be prepared and delivered. All broadcasts should be approved by the radio committee before presented. If your society cannot prepare radio broadcasts, write to the Bureau of Public Relations, the A.D.A. Central Office, for copies. This bureau has more than 200 prepared broadcasts that have been approved by the A.D.A. and the U.S.P.H.S.

5. National radio broadcasts.

Through the courtesy of the Columbia Broadcasting System, the American Dental Association is delivering one weekly fifteen-minute broadcast over their network. These talks are made available to more than forty Columbia stations. If your local Columbia station does not carry them, request them to do so. If they do carry them, ask your patients and friends to listen in.

All society officers are requested to write the Columbia Broadcasting System, 485 Madison Ave., New York City, thanking them for their cooperation in making these educational talks available to more than two-thirds of the citizens of the United States.

During the coming winter, the Bureau of Public Relations plans to vary these regular dialog programs with several dramatized broadcasts.

6. Dental health newspaper articles.

Contrary to popular opinion, newspaper editors will print short dental health columns if they are well prepared and contain reader interest. This is particularly true of the smaller papers. The Public Relations Committee of each state and component society should develop this little used avenue for dental education. All articles should be carefully prepared and even more carefully edited before they are submitted to the papers. Of course, all editors will not print them, but enough to make the effort worth while will. Those societies that prefer to do so can secure newspaper articles from the Bureau of Public Relations. The John, Mary and Jack series is still available and a new series of shorter articles is in the process of preparation.

7. Preventive dentistry for children.

At least 90 per cent of American school children suffer from dental decay, much of which is preventable. Until science develops better preventive procedures, so-

ciety must depend on present known methods. The dental profession must provide society with those methods. The best preventive procedures known today are early education and early operation. Educate children early in life to appreciate healthy teeth and to care for them from a dietary and sanitary standpoint. Educate the public to seek, and the dentists to provide, early operative preventive care.

State and component societies are urged to intensify their preventive programs. There are a number of well-established methods by which organized dentistry can reach the prenatal, preschool and school groups; and all of these groups should be reached with both education and dental care. The prenatal groups can be reached through women's clubs, parent-teacher associations, nurses' associations and the private office.

The preschool groups can be reached through the same channels, particularly the parent-teacher organizations.

State and component societies are urged to cooperate with the parent-teacher association in its summer round-up activities. Examine all preschool children and correct all their dental defects before they enter the first grade in school.

8. School dental programs.

Because of the prevalence of dental decay among children and because of the ease with which school children can be reached, all dental societies should promote a practical dental program for the school children in their communities. A school program should provide dental examinations for all elementary children and a definite educational follow-up. Dental examinations are essential for statistical purposes; but unless followed up by a good educational program, they are ineffective.

Dental examinations should be made by dentists. To save time and public expense, the school authorities should insist that children be examined by the family dentist and bring a statement to the teacher from the dentist regarding their dental condition. This method will provide most children with an annual examination at no public expense. Children whose parents are unable to provide them with the services of a private dentist should be examined by the school dentist. From 25 to 75 per cent of the school dentist's examination work will be eliminated by this plan, which will permit of many more examinations being made. At the present time, dental inspection service is limited. Furthermore, it will send more children to the private dental office, where the best type of examination can be made.

All examinations should be made for the prevention of defects, not merely for the finding of cavities.

Follow-up after the examination is absolutely essential. School authorities should use every effort to encourage children to have all defects corrected. Here again, we must fall back on education. It is not likely that law can force parents to provide dental care for their children if they do not wish it. However, by proper educational procedures, most parents and children can be led in the right direction. Write to the Bureau of Public Relations for a copy of the article entitled "A Practical Dental Health Educational Program." Also write to the same source for a catalog of dental health educational material.

9. A course in dental health for teachers and nurses.

Every teacher, college student and student nurse should receive a course in dental health. One of the most important steps that any state dental society can take is to see that an accredited course in dental health is added to the curriculum of all teachers and nurses schools.

Arrange with the proper authorities to have a dental health lecture presented at county teachers' institutes and for dentists to appear on local and state medical society programs.

10. Cooperation with other organizations.

State and component dental societies are urged to cooperate with other organizations which are interested in child health work. Dental officers could be appointed to examine the teeth of, and furnish educational material to, the members of such organizations as the 4-H Clubs, Boy Scouts, Girl Scouts, Camp Fire Girls and boys' clubs.

11. A preventive dentistry issue of state bulletins.

At least one issue of each state and component society dental bulletin should be devoted almost entirely to preventive dentistry and children's dentistry. The members need educating as well as the public and this is one means of education. Carry the slogan on all journals.

12. Preventive dentistry programs.

State societies should stress preventive dentistry at their annual meetings.

Component societies that meet monthly or bimonthly should devote one entire meeting to this subject.

13. Preventive dentistry clinics.

Several state societies in the past have sponsored traveling child dentistry clinics for their members. This is an excellent idea and one that every state society might well copy. These clinics, presented by specialists or semi-specialists, could be given in different localities in each state so that all members could learn more about this important work.

14. Dental care for indigent children.

In every community, there is a varying number of children from indigent families that require dental care. Plans should be perfected in each community to provide these children with the necessary service. Because of varying conditions in different communities, these plans must, of necessity, vary. But supplying preventive dental care to indigent children is not an impossible task if approached intelligently and without bias. State and component societies are urged to make a thorough study of this problem in their communities and to establish, through local means, methods of solving it.

It is believed that assistance in this connection may be forthcoming from the Children's Bureau Department of Labor after a conference with the Dental Advisory Committee, which will be held shortly in Washington, D. C. Further information concerning this conference will be transmitted at a later date.

15. Dental divisions in state health departments.

In those states that now have a dental division or bureau in their state health departments, the state dental society should cooperate very closely with those divisions in order to aid and strengthen their public health work. In those states that do not have a dental division in the state health departments, the state dental society should use every influence possible to have one established. Preventive dentistry is a recognized public health measure and dentistry should be included in all state public health work.

16. Research on dental caries.

Despite the fact that dental decay is the most prevalent of childhood diseases, an alarmingly small amount of research work is being done to determine its cause. Every state society could well afford to establish a research committee which could study the different angles of this problem. By working with state orphanages and other institutions studying diet and other conditions, it is not unlikely that some day a state society might solve this question. Certainly dental colleges and other interested institutions could increase their research in this field.

These are but a few suggestions, which, if carried out by organized dentistry, will help immeasurably in promoting a preventive program for children.

Its success will be measured by the amount of cooperation received from the state and component dental societies.

Society turns to organized dentistry for a solution of its dental problems.

At the present time, knowing as little as we do about the etiology of dental caries, we can only offer society the preventive principles that have proved, by test, to be effective; namely, early education and early operation.

Not only must organized dentistry offer these measures to society but, knowing the apathy of human beings generally to their own welfare, we should also, in an impressive but ethical manner, bring these measures before them for their own good.

The cost of a preventive program is negligible and the results are positive. The cost of a reparative program is prohibitive and the results are comparatively negative. Once organized dentistry has established a practical preventive program in every community in the United States, the public and the profession will need have little fear of socialized dentistry.

On behalf of the American Dental Association and the citizens whom we serve, I earnestly request the cooperation, help and advice of every officer and member of every state and component society, in order that, collectively, we may launch and direct an effective and sustained preventive program for the children of America.

A.D.A. RADIO BROADCASTS OVER COLUMBIA NORTHWEST AND SOUTHWEST CHAINS

THROUGH the cooperation of the Columbia Broadcasting System, the American Dental Association's weekly radio programs are being made available to the following stations at 12:15 p.m., Central Standard Time:

WBRC—Birmingham, Ala.
WALA—Mobile, Ala.
KLRA—Little Rock, Ark.
WJSV—Washington, D. C.
WMBR—Jacksonville, Fla.
WQAM—Miami, Fla.
WDBO—Orlando, Fla.
WDAE—Tampa, Fla.
WJNO—West Palm Beach, Fla.
WTOC—Savannah, Ga.
WOC—Davenport, Iowa
KRNT—Des Moines, Iowa
WKBB—Dubuque, Iowa
KSCJ—Sioux City, Iowa
WIBW—Topeka, Kan.
KFH—Wichita, Kan.
KWKH—Shreveport, La.
WCCO—Minneapolis, Minn.
WCOC—Meridian, Miss.
KMOX—St. Louis, Mo.
KFAB—Omaha, Nebr.
WBT—Charlotte, N. C.
WBIG—Greensboro, N. C.
WSJS—Winston-Salem, N. C.
WHIO—Dayton, Ohio
KOMA—Oklahoma City, Okla.
KTUL—Tulsa, Okla.
WHP—Harrisburg, Pa.
WAIM—Anderson, S. C.
WNAX—Yankton, S. D.
KNOW—Austin, Texas
KRLD—Dallas, Texas
KTRH—Houston, Texas
KTSA—San Antonio, Texas
WACO—Waco, Texas
KGKO—Wichita Falls, Texas
WDBJ—Roanoke, Va.
WMMN—Fairmont, W. Va.
WTAQ—Green Bay, Wis.
WISN—Milwaukee, Wis.
WMBD—Peoria, Ill.

SUBJECTS AND DATES FOR THE COMING MONTH

October 5: Teeth, Like Billboards, Advertise Your Wares
October 12: The Modern American Siwak
October 19: Early Arabian Dentistry
October 26: Relation of Dental Infection to Systemic Disease

REPORT OF THE COMMITTEE ON SCHOOL DENTAL PROGRAMS FOR CHILDREN OF THE AMERICAN SOCIETY FOR THE PROMOTION OF DENTISTRY FOR CHILDREN

THE widespread incidence of dental disease is a challenge to modern civilization. All competent surveys show that most adults have been subject to the ill effects of dental decay. That the promotion of dental health involves attention to systemic conditions and to local operative procedures during childhood is now recognized. A consensus of expert opinion would reveal that an improvement in dental conditions requires two approaches: (1) research to establish effective preventive measures and (2) health education programs to insure the adoption of dental health practices.

The American Society for the Promotion of Dentistry for Children has given careful study to the progress made in private practice and in community dental service and educational programs for children. The importance of this whole question prompted the society to appoint a committee in September 1935 to clarify the issues and basic policies concerned in the establishment, management and operation of community dental service programs for children throughout the United States.

The objectives of the committee were as follows:

1. To obtain a representative cross-section of expert opinion regarding attainable administrative policies for community dental programs for children.

2. To obtain authentic opinions regarding some of the basic operative technics and procedures involved in community dental service programs for children.

3. To determine the feasibility of recommending courses or lectures in frontier subjects to increase the efficiency of dentists participating in community dental service programs for children.

Jour. A.D.A. & D. Cos., Vol. 24, October 1937

In order to secure the desired information for the attainment of these objectives, a working committee of nine was appointed from the membership of the American Society for the Promotion of Dentistry for Children and an advisory committee comprised of members and non-members of the society.

The members of the advisory committee, made up of authorities in educational, public health and dental fields, presented their opinions concerning dental programs by answering a submitted questionnaire. The working committee prepared the following report from the answers to the questionnaires and voluntary remarks of the advisory committee.

Value of Recognized Procedure

Question: Would a nationally recognized procedure for the dental service programs for children be useful as recommendations for general principles involved?

Replies: Yes, 47; no, 6; not answering question, 2; total, 55.

Conclusion: With such an overwhelming expression of opinion on this point, the committee concluded that a study of general procedures applicable under varying conditions should be undertaken. Its findings will be presented under three headings: (1) administrative policies for community dental service programs for children, (2) basic operative procedures for community dental service programs for children and (3) qualifications of participating dentists.

Administrative Policies

sponsors

Question: Who should sponsor community dental service programs for children?

Replies: Only boards of health, 12; only boards of education, 1; joint administration, such as board of health supervising program for children other than those of the public schools and the board of education supervising programs for children in public schools, 28; either board of education or board of health, according to local conditions, 2; naming other available sponsors, 7; total, 55.

Question: Do you believe it feasible to give dental societies the responsibility of setting up professional policies for dental service programs?

Replies: Yes, 36; no, 17; not answering, 2; total, 55.

PROFESSIONAL SUPERVISION BY DENTIST

Question: Should community dental service programs for children have the benefits of professional dental supervision in addition to administrative direction as considered in the previous question?

Replies: Yes, 53; no, 0; not answering, 2; total, 55.

USE OF TERM "INDIGENT"

Question: Should the meaning of the term "indigent" be used broadly to refer to those unable to pay for dental treatment?

Replies: Yes, 43; no, 10; not answering, 2; total, 55.

SELECTION OF CHILDREN FOR TREATMENT IN COMMUNITY DENTAL SERVICE PROGRAMS

Question: With limited funds available, what care should be given indigent children?

Replies: Dental service programs providing for all indigents (giving complete treatment [fillings, extractions and prophylactic cleaning] to all indigent children), 22; dental treatment limited to emergency treatment (treatment of painful and infected teeth only) for indigent children, 1; dental treatment to be given to younger (preschool included) indigent children and emergency treatment to older indigent children, 32; total, 55.

METHODS OF OBTAINING FUNDS FOR PROGRAMS

Question: How should the program for indigent children be supported?

Replies: By state, county or municipal government funds, 42; by endowments, 6; by community chests, 0; by other methods, 4; not answering, 3; total, 55.

DENTAL HYGIENIST

Question: Should the dental hygienist be included in the community dental program for children?

Replies: Yes, 41; no, 8; not answering, 6; total, 55.

REMUNERATION OF DENTISTS PARTICIPATING IN PROGRAMS

Question: What method of paying the operating dentist is most conducive to maximum results?

Replies: A salary, 47; a stipulated fee for each operation, 4; either a stipulated fee for each operation or a salary, 3; no remuneration, 1; total, 55.

Basic Operative Procedures for Community Programs

EXAMINERS

Question: Who can conduct the dental examination of children in groups most advantageously?

Replies: A dentist, 51; a physician, 0; a hygienist, 4; a nurse, 0; total, 55.

TYPE OF EXAMINATION

Question: What instruments should be used in making the examination?

Replies: Tongue depressor, 0; mirror and explorer, 54; not answering, 1; total, 55.

PITS AND FISSURES*

Question: Should all pits and fissures be treated routinely in permanent and deciduous teeth?

Replies: Yes, 16; no, 9; not answering, 1; total, 26.

*Question submitted to dentists only.

PULP TREATMENTS*

Question: Should pulp treatments be given in such programs?

Replies: Yes, 14; no, 11; not answering, 1; total, 26.

FILLING MATERIALS

The filling materials that should be used in community dental service programs for children are listed in the accompanying table.

QUALIFICATIONS OF PARTICIPATING DENTISTS

The qualifications discussed here are presented with the ultimate attainable standards in mind and not as present-day requirements.

Supervising Dentists.—The following qualifications were included in the survey:

1. License to practice dentistry.
2. Training in school dental service.
3. Dental school and postgraduate study in children's dentistry.
4. College credit courses in the following subjects.
   (a) Methods of health education.
   (b) Administration of health education programs.
   (c) Statistics in public health work.
   (d) Educational psychology.
   (e) Public health.
   (f) Child hygiene.
   (g) Nutrition.
   (h) Principles of elementary education.
   (i) Principles of secondary school education.
   (j) History of education.
   (k) Educational sociology.

Question: Do you agree that the supervising dentist should have the qualifications listed?

Replies: Some may be omitted, 19; none should be omitted, 27; not answering, 9; total, 55.

Question: Should additional requirements be made?

Replies: Yes, 12; no, 27; not answering, 16; total, 55.

Operating Dentists.—The following qualifications were listed:

1. License to practice dentistry.
2. Training in children's dentistry (postgraduate study) or graduate of dental school presenting course in children's dentistry.

FILLING MATERIALS

Type		Where indicated
Silver amalgam alloy		Posterior deciduous and permanent teeth
		Anterior deciduous teeth
Synthetic porcelain cements		Anterior teeth in older children
Kryptex		Occlusal fissures
		Anterior teeth
Copper amalgam		Posterior teeth, especially cervical fillings
Copper cement, white	To be used	Anterior teeth
Copper cement, red	for	Posterior teeth
Silver cement or equivalent	temporary	Sedative treatments
Oxyphosphate of zinc	service	Pulp protection
Zinc oxide—eugenol	only	Sedative treatments

*Question submitted to dentists only.

3. College credits in the following subjects:

(a) Child psychology.

(b) Child hygiene.

Question: Should any of the qualifications for operating dentists be omitted?

Replies: Yes, 10; no, 34; not answering, 11; total, 55.

Question: Should additions be made to the qualifications listed?

Replies: Yes, 12; no, 24; not answering, 19; total, 55.

Question: Will there be a demand for dentists with such qualifications?

Replies: Yes, 38; no, 5; not answering, 12; total, 55.

Question: Should school dentists be full-time appointees?

Replies: Yes, 36; no, 12; not answering 7; total 55.

Recommendations

In presenting its recommendations, based on the results of this survey, the committee wishes to call attention to the fact that they are offered as a guide for developing community dental service programs for children.

The comment may be made that such recommendations must be flexible to fit the needs of particular situations. It may be true that character and location of the community and availability of dentists, funds and educational opportunities will determine their feasibility. Thus, basic policies may be flexible to meet varying conditions; but general principles on which these policies are predicated are not flexible.

The Committee on Standards for School Dental Programs, fully realizing the existence of these varying conditions, but hoping for programs scientifically planned, submits the following recommendations:

1. That the Bureau of Public Relations of the American Dental Association, the Public Health Committee of the American Dental Association, the American Society for the Promotion of Dentistry for Children and the United States Public Health Service cooperate in periodically publishing attainable standards for community dental service programs for children.

2. That the boards of education, boards of health and dental societies collaborate in community dental service programs for children.

3. That community dental service programs for children be supervised by dentists, who should acquire available knowledge in health education and public health technics.

4. That operators employed in community dental service programs be well grounded in authentic methods of operative procedures in dentistry for children and in the management of children.

5. That community dental service programs for children be limited to underprivileged children and that emphasis be placed on preventive service.

6. That funds for dental service programs for the underprivileged children be secured from tax-supported agencies.

7. That the American Dental Association, through the Bureau of Public Relations and the Committee on Public Health, collaborate with the American Society for the Promotion of Dentistry for Children and the United States Public Health Service in designating charts and procedures for group dental inspection of children so that it will be possible to obtain more uniformity in reports.

8. That examinations for determining dental needs of groups be conducted by dentists using mouth mirror and explorer. (Walker II type.)

9. That dental hygienists of recognized training in education, child psychology and public speaking be included in community dental service programs conducted under dental supervision.

10. That the following materials be recommended for operative procedures in community dental service programs for children:

Silver amalgam alloy for posterior (deciduous and permanent) teeth.

Silicate cements with protective linings for anterior permanent teeth.

Zinc oxide and eugenol for pulp protection.

Copper and silver cements for linings, steps and treatments.

Pulp treatments are not recommended in clinical cases except where, in the judgment of the operator, the unusual conditions may indicate the retention of a tooth through pulp treatments.

11. That pits and fissures in deciduous and permanent teeth be filled.

By the Committee

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J. M. WISAN, D.D.S., *Chairman*
Elizabeth, N. J.

THE SCIENTIFIC AND HEALTH EXHIBITS AT ATLANTIC CITY

THOSE who attended the Atlantic City meeting last July will long remember the Scientific and Health Exhibits that occupied over half the main floor of the gigantic Convention Hall; but few, if any, of those who admired the exhibits realized the amount of time, energy and money expended to make them possible.

To recompense exhibitors for their contribution and to create more interest in this department of the Annual Session, the Scientific and Health Exhibit Committee, under the direction of George B. Winter, inaugurated a plan whereby the exhibits will be judged each year and the winners given an award. The exhibits, for judging purposes, are divided into Class A presentations of individual and original investigation; Class B presentations of material or technics that will be helpful to the practitioner, not necessarily original studies, and Class C, health educational projects.

The winners in the three divisions at the 1937 meeting are as follows:

Class A: Award, Isaac Schour, University of Illinois, Chicago, Ill. Honorable mention, Rudolf Kronfeld, Foundation of Dental Research, Chicago College of Dental Surgery; Joseph S. Landa, New York University, New York City; St. Agnes Hospital: G. M. Dorrance, J. W. Bransfield, J. H. Gunter and P. Phillip Gross, Philadelphia, Pa.; J. R. Schumaker, Northwestern Dental School, Chicago, Ill., L. M. Waugh, New York City.

Class B: Award, University of Pennsylvania, School of Dentistry, Charles R. Turner, dean, Philadelphia, Pa. Honorable mention, Columbia University, School of Dentistry: Isador Hirschfeld and Sidney Riesner, New York City; Harvard University Dental School and Beth Israel Hospital: Kurt H. Thoma, M. Michael Cohen and Harry F. Friedman, Boston, Mass.; Medical College of Virginia, School of Dentistry: A. H. Fee, G. W. Duncan and J. Frank Hall, Richmond, Va.; New York University: Waite A. Cotton, Joseph S. Landa and Charles G. Darlington, New York City; Temple University Dental School, I. N. Broomell, dean, Philadelphia, Pa.

Class C: Award, U. S. Indian Service, Leslie W. Foster, Albuquerque, N. M. Honorable mention, American Medical Association: Thomas J. Hull, M.D., Chicago, Ill.; Walter Emerson Briggs, Attleboro, Mass.; New York Institute of Malignant Diseases: Harry A. Solomon, Buffalo, N. Y.; Ohio State Depart-

ment of Health, Bureau of Dental Hygiene: D. L. Houser, Columbus, Ohio; U. S. Public Health Service, Clinton T. Messner Memorial, Washington, D. C.

A picture of the exhibit presented by Leslie W. Foster, D.D.S., of the U. S. Indian Service, that won first place in Division C is shown herewith.

Exhibit of Leslie W. Foster, D.D.S., U. S. Indian Service, winner of first place in Division C, Scientific and Health Exhibit Section, Atlantic City, N. J., July 1937.

AMERICAN DENTAL ASSOCIATION APPOINTMENT BOOK

TURN to page A-36 of this issue. Read the appointment book advertisement. Fill out the coupon and mail it in at once. We know that most members of the A.D.A. will want this A.D.A. appointment book 1938. Bound in black imitation leather, gold-stamped and loose-leafed, it lies flat when open and shows a full week's appointments at a glance. Besides the appointment pages it contains much useful information regarding the A.D.A.

MICKEY MOUSE RECALL CARDS FOR CHILDREN

JUST to remind you that it is now time to turn to page A-38 of this issue and order some of the new children's recall cards. Children are thrilled to receive a letter addressed to themselves. They love Mickey Mouse and his delightful companions. Therefore, make Mickey and the postman work for you. We sincerely believe that these new whimsical little recall cards will help your younger patients and, incidentally, yourself.

DENTAL ECONOMICS

THIRD DENTAL CLINIC SURVEY IN NEW YORK CITY*

FOREWORD

THE Committee on Community Dental Service, a professional, volunteer committee of the New York Tuberculosis and Health Association, has recently completed a study of dental clinic services in Greater New York. This is the third dental clinic survey to be made for New York City in the past dozen years.

The first, in 1923, under the auspices of the United Hospital Fund Committee on Dispensary Development, of which Michael M. Davis, now of the Julius Rosenwald Fund, was the executive secretary, among other recommendations urged the establishment of a permanent group to promote dentistry in the city's public health activities. As a direct result, the Committee on Community Dental Service was formed early in 1925.

The second survey, made by the Committee on Community Dental Service in 1927, measured the progress toward improved dental practice standards during the intervening years since the first study.

The present study, completed in June 1936, was stimulated by the United Hospital Fund, in order to provide information as to dental facilities for "The Hospital Survey for New York," a comprehensive report of organized care of the sick in the metropolitan area, with a forecast of the needs of 1965.

In the foreword to the present study "Service in Dental Clinics in Greater New York," the Committee on Community Dental Service asserts:

In spite of evident progress in the recognition of the benefits from dentistry as a health service, the major objectives of the committee at the time of its establishment in 1925 are still to be sought, namely:

For the lay public, regular dental attention for all children from the age of two years, and education in the importance of mouth hygiene, including home care, diet and periodic examination and correction of beginning defects by a dentist.

For the hospital patient, in all instances of chronic disease, and in other cases where condition permits, a routine mouth examination by a dentist to discover foci of infection and unhygienic conditions needing treatment; in general anesthesia cases, except in emergencies, oral prophylaxis to cleanse the mouth and prevent postoperative pneumonia caused by aspiration of loose particles in and around the teeth during prolonged anesthesia.

The Committee urges the recognition of these principles, in order that physicians and dentists may cooperate "in the prevention and treatment of dental disease and the improvement of community health." It is pointed out that basic dental service for the hospitalized patient could be provided if it were made mandatory for graduate dentists and hygienists to serve internships in institutional or public service.

The Committee is well known for its unique studies in dentistry in relation to the public's health.

*The latest study of the New York Tuberculosis and Health Association.

THIRD DENTAL CLINIC SURVEY IN NEW YORK CITY

By JOHN T. HANKS,† Chairman, Committee on Community Dental Service, New York City

When the United Hospital Fund undertook, recently, to make a survey of hospital facilities and hospital care in New York City, a request was made that the Committee on Community Dental Service of the New York Tuberculosis and Health Association make a survey of the dental clinic facilities of the city for inclusion in the report. In this article are summarized the findings of the subcommittee‡ which carried out this assignment. The complete report will be found in "The Hospital Survey for New York." Other committees of the New York Tuberculosis and Health Association contributed reports on tuberculosis, heart diseases, diabetes and social diseases.

Perhaps the most surprising fact uncovered in the dental study was that the increase in clinic patients in relation to population in New York City between 1930 and 1934 was negligible. In 1930, 3.61 per cent of the population registered in dental clinics. In 1934, clinic service was utilized by 4.54 per cent, an increase of only nine and three-tenths patients per thousand population, less than 1 per cent. Moreover, 85 per cent of this increase in relation to population was in free public tax-supported institutions caring for the victims of the depression, notably the WPA Dental Clinics, the Department of Hospitals and the Department of Health.

In comparing the number of patients admitted to clinics in 1930 with the number admitted in 1934, without reference to increased population, a different picture is drawn: 30.8 per cent (77,410) more patients were registered in the latter year; 26.1 per cent in the free public tax-supported institutions, and only 4.7 per cent in all other dental clinics licensed by the State of New York Department of Social Welfare.

The dental study was approached from three angles: (1) the incidence of dental disease, (2) existing treatment facilities outside of the private office, and (3) future community needs.

Discussion of the incidence of dental disease cites authoritative statistics about tooth decay and gum disorders familiar to all dentists. It warns against the complacency with which serious dental infection is accepted by the general public, and lays this tolerance of disease to the almost universal occurrence of dental defects.

The survey of existing facilities is based on a detailed study of 156 of the 249 clinics found operating all or part of the time between 1930 and the present. Distribution of services by neighborhood is shown, and classification as to auspices, whether public (city or federal government) or private (voluntary agencies such as hospitals, unattached clinics, dental colleges and welfare agencies).

Clinics studied include 127 free public tax-supported services under city or federal government auspices and twenty-nine other clinics under voluntary agencies which served more than 1,800 patients in 1934. The seventy-nine clinics not studied treated only 13.5 per cent of the dental patient load, and represent the small, isolated services.

A district by district comparison of 1934 clinic patients to population indicates that 20.71 per cent of the lower

†Deceased.

‡Subcommittee on the Hospital Survey for New York: Theodor Blum, Oscar J. Chase, Jr., John T. Hanks, chairman; Pauline Warner, secretary and field worker.

TABLE 1.—DISTRIBUTION AND CLASSIFICATION OF DENTAL CLINIC SERVICES*

Distribution	Total Clinics		1930				1934			
			Patients		Visits		Patients		Visits	
	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent
Manhattan	111	44.6	173,116	69.0	377,988	67.1	197,111	60.0	579,858	60.9
Bronx	38	15.3	20,948	8.3	41,952	7.4	38,026	11.6	109,300	11.5
Brooklyn	70	28.1	50,037	20.0	124,430	22.1	69,299	21.1	188,668	19.8
Queens	24	9.6	5,629	2.2	15,230	2.7	19,467	5.9	60,937	6.4
Richmond	6	2.4	1,391	0.5	4,005	0.7	4,628	1.4	13,300	1.4
Greater New York	249	100.0	251,121	100.0	563,605	100.0	328,531	100.0	952,063	100.0
Classification										
Service not in operation April 1936	12	4.8	8,442	3.4	43,759	7.8	3,027	0.9	26,371	2.8
Service limited to prophylaxis	17	6.8	7,253	2.9	8,824	1.6	7,823	2.3	9,221	1.0
Department of Health operative service	92	37.0	20,466	8.2	56,588	10.0	54,581	16.6	168,344	17.7
Department of Hospitals extraction service	13	5.2	44,528	17.7	80,765	14.3	64,865	19.7	161,539	17.0
WPA emergency relief service	7	2.8	.....	.....	.....	.....	11,319	3.4	46,866	4.9
Service under voluntary auspices (studied)	29	11.7	131,671	52.4	259,652	46.1	149,611	45.5	395,587	41.5
Service under voluntary auspices not studied	79	31.7	38,761	15.4	114,017	20.2	37,305	11.4	144,135	15.1
Grand total	249	100.0	251,121	100.0	563,605	100.0	328,531	100.0	952,063	100.0

*Abridgment of Tables I and III in "Service in Dental Clinics in Greater New York."

east side population are treated in dental clinics in that district. This is the highest percentage in the city. In the Kips-Bay Lenox Hill district, the middle east side, 17.22 per cent of the residential population are clinic patients. The lower west side and Washington Heights, with clinic patients, respectively, 11.33 and 11.27 per cent of the population, follow. These four districts are the centers for the concentration of large clinics, having within their boundaries a third of all dental clinics, and treating a half of all dental clinic patients. Of course, to say that 20.71 per cent of the residents of the lower east side are clinic patients is to assume that all the patients attending lower east side clinics live in the district, which is convenient for a comparison, but cannot be proved true.

Table 2.—Findings in Twenty-Nine Voluntary Clinics

	Manhattan	Bronx	Brooklyn	Queens	Total
Voluntary clinics	17	3	6	3	29
Staff dentists	341*	84	179	29	633
Dental chairs	450	13	40	5	508
Chair hours per week	13,591	235	515	183	14,524
Full time use (per cent)	91.5	54.8	39.0	111.0	86.6

*Including 163 dentists in the colleges who supervise the work of students.

As the administration of the free public tax-supported services is generally well understood, findings in the twenty-nine large clinics under voluntary auspices will be considered in this résumé. Table 2 shows the distribution of clinics, staff dentists, dental chairs, and chair hours per week used in each borough.

Services and fees are presented in full in Table 3 as they appear in the study. Classification according to low, high, median and most usual seemed the most satisfactory way to indicate the average and the extremes.

The chief critical findings of the study and suggested constructive action for the immediate improvement of dental clinic services are embodied in the following recommendations.

GENERAL CLINIC ORGANIZATION

1. Every dental clinic needs a professional supervisor to assume responsibility for the quality of the work, and to be in regular contact with the operators for consultation. The professional supervisor (or dental chief) should be a general practitioner rather than a specialist, in order that dentistry may be considered from the standpoint of normal health and function.

2. Technical and non-technical responsibility should be distinctly separated, with a clinic executive (not a dentist) responsible for all non-technical details.

3. Few clinics are keeping adequate records, including number of patients, visits and different operations. Where the proportion of each type of service offered is not known, the value of the dental clinic to the institution cannot be determined.

4. In an outpatient service, definite appointments should be given to patients, in order to eliminate the unnecessary hardship of the waiting line for ailing patients, and to distribute the daily load of work evenly.

5. Follow-up of patients to insure completion of necessary treatment and to encourage periodic re-examination is obligatory if the dental service is intended as a health measure rather than as an emergency stop-gap.

6. Reference of incomplete cases to the social service department for further planning should be routine in clinics where all the services needed by the patient are not provided. This applies particularly to extraction services from which the patient is dismissed while still in need of fillings, gum treatment or artificial dentures.

7. The demand for dental service, largely based on emergency pain, has no relation to the need, based on incidence of dental disease.

SCHOOL DENTAL PROGRAM

1. The most economical service from the community point of view is that to the youngest age group, in which defects are slight and prevention of major destruction is possible.

TABLE 3.—FEES IN TWENTY-NINE DENTAL CLINICS

Clinics	Service	Fees			
		Low	High	Median	Most Usual
26	Examination	0	$ 1.50	$ x–0.10	$0.00 in 11 clinics
28	Prophylaxis	0	2.00	0.50	0.50 in 10 clinics
	X-ray film				
25	Single	0	1.00	0.50	0.50 in 8 clinics
17	Series	0	4.00	3.00	3.00 in 6 clinics
	Extraction, local anesthesia				
29	Deciduous tooth	0	1.00	0.50	0.50 in 14 clinics
29	Permanent tooth	0	1.50	0.50	0.50 in 13 clinics
	Extraction, general anesthesia				
17	Deciduous tooth	0	2.00	1.00	1.00 in 6 clinics
17	Permanent tooth	0	2.00	1.00	1.00 in 5 clinics
17	Other oral surgery	0	10.00–20.00	1.50	No 3 clinics alike
	Fillings				
24	Deciduous tooth	0	2.00*	0.50	0.50 in 10 clinics
25	Permanent tooth	0	6.00†	0.50–1.00	0.50 in 7 clinics
8	Root canal	0	8.00	3.00–5.00	No 3 clinics alike
	Artificial dentures				
13	Full upper or lower	x	22.00	18.00–22.00	20.00 in 6 clinics
12	Partial upper or lower	x	40.00	20.00–25.00	17.50 in 3 clinics
2	Lingual, palatal bar	30	45.00	40.00	Only 2 clinics reported
2	Fixed bridge, unit	15	21.00	15.00–21.00	Only 2 clinics reported
	Treatments				
17	Gingivitis	0	2.00 per case	0.25	0.25, 0.50 in 5 clinics each
14	Pyorrhea	x	5.00 per ¼ mouth	0.50	0.50 in 6 clinics
15	Vincent's infection	0	2.00–15.00 per case	0.50	0.50 in 5 clinics
	Orthodontia				
7	Initial charge	x	55.00	15.00	No 3 clinics alike
7	Month or visit	x	10.00	5.00	No 3 clinics alike

*Gold foil.
†Inlay.

2. The use of all existing dental equipment in the department of health will make it possible to provide 29,532 children a year with complete operative service, and an additional 113,717 children with diagnosis. Such a program, four-fifths preventive and educational, will reach a third of the children from kindergarten through grade 4B of the public schools.

3. Further expansion of the school program of dentistry for needy children, as needed, should be through the purchase of supervised service in private offices adjacent to the schools.

4. The municipal budget should be adjusted to absorb the expense of service now provided by WPA funds when these funds are discontinued.

WPA CLINICS

1. Dentists assigned to work in WPA clinics should be subject to examination as to their professional qualifications. The dental program of the WPA should have the benefit of professional supervision not employed by the WPA, preferably a volunteer joint committee appointed by the official dental societies to act in an advisory capacity.

2. Provision should be made for the dental care of adolescents on Emergency Relief. At present, this age group is excluded from WPA dental clinic service.

HOSPITAL DENTAL SERVICE

1. The first and most important function of the hospital dental service is the care of patients admitted for other conditions, the obligation to the patient applying for dental work only being secondary.

2. At the present time, dental service for in-patients is not sufficiently general. Required internship for dentists and dental hygienists would supply the personnel for basic dental service in hospitals.

3. A medical examination is incomplete without a dental examination, the latter preferably following prophylaxis and employing x-rays to determine root and bone conditions. The routine mouth examination of patients with medical conditions directly correlated with oral sepsis cannot be instituted too soon for the welfare of such patients. In other cases, when resistance is low, untreated oral infection adds an unnecessary strain to the constitution.

4. A more general practice of oral prophylaxis is indicated. While no hospital patient can be named who would not benefit from a clean mouth, this service is especially urged for all general anesthesia cases, except in emergencies. Prophylaxis as part of the routine preparation of the patient for a general anesthetic is credited with reducing postoperative pneumonia to an almost negligible percentage. The value of oral prophylaxis as a routine procedure in prenatal care is twofold. Not only is the expectant mother's mouth cleansed and examined for evidence of dental disease requiring treatment before her confinement, but also the opportunity is unsurpassed for instruction in general hygiene during pregnancy, as well as dental hygiene for herself and her family. This service can be administered effectively and economically by a dental hygienist under supervision of a dentist.

5. Because the correlation between the oral condition and the medical condition for which the patient is admitted for care is closer than such correlation in many other specialties commonly represented on medical boards of hospitals, it is recommended that dentistry have representation on medical boards of all general hospitals equal to that of any other medical specialty.

6. There is little doubt that the cost of the more general recognition of dentistry in both diagnosis and therapy in hospital service would be more than saved in reduction of hospital days per patient and more rapid, less eventful recoveries.

Four cardinal objectives, which appear from time to time in the body of the text, are here reiterated and expanded:

1. Regular dental attention for all chil-

dren beginning with the age of two years.

2. Routine mouth examination by a dentist for all hospital patients, condition permitting.

3. Routine prophylaxis, except in emergencies, for all general anesthesia cases.

4. Education of the public in the importance of mouth hygiene, including home care, diet and regular examination and correction of beginning defects by a dentist.

To quote the final words of the Committee in this study, "Private attention and public attention must be riveted on prevention if we as a people are to enjoy the benefits of mouth health and its corollaries, general physical protection and esthetic satisfaction."

ARE WE "ATTACKING CAVITIES WITH A TOOTHPICK"?

JOHN OPPIE MCCALL, D.D.S., New York City

AT the close of the recent meeting of the American Dental Association, the *Philadelphia Record* carried an editorial with the title "Attacking Cavities with a Toothpick."

The dentists of America aren't doing half the job they should. They admit it. They point out that 70 per cent of the people in the United States are not receiving adequate dental care.

In Atlantic City 15,000 dentists are meeting to devise ways of rendering the benefits of dentistry to all the people.

Dr. W. J. Carrington, president-elect of the Medical Society of New Jersey, dramatically called upon the dentists to stand beside the physicians in opposing "State" medicine and dentistry. Dr. Carrington admitted that "something must be done." He urged the organized dentists to "pull together" to give health service to the low income groups at reduced fees.

After much talk, during which socialized dentistry was condemned and recondemned, the Dental Association's committee on public health has submitted to the dentists its idea of a solution to the problem:

"Creation of dental service sections in the health departments of each of the 48 States under strict supervision of licensed dentists.

"Organization of special courses in public health in all dental schools, with the granting of the degree 'doctor of dental public health' to graduates of these courses. Assigning of the special course graduates to the dental service section in the various States."

The dentists are tilting at cavities with toothpicks. They want to fight bad teeth with public lectures, college courses and subdivisions in State health departments.

The *Record* is opposed to socialized medicine and socialized dentistry.

But neither our doctors nor our dentists have made any serious effort to solve the health problem of those people now without proper medical and dental attention. [Italics in original.]

Condemnation would be easier were it not for the fact that most medical men, personally, are charitable. As individuals they give of their time, skill and energy unstintingly.

But the problem of adequate medical and dental care cannot be solved by individual charity of individual practitioners. It cannot be met by "asking" doctors and dentists to "cooperate." Some sort of organization must be set up to assure all the people in this country adequate medical and dental care.

If the doctors and the dentists refuse to organize such a group; if they continue to waste time passing meaningless resolutions and making meaningless suggestions:

The public will be forced to step in and do the job for them. [Italics in original.] We hope that won't be necessary. But if it comes to a choice between no dental care for 70 per cent of the people or State dentistry—we prefer State dentistry.

The *New York Journal of Dentistry*,[1] in commenting, inquires as to whether the public in general holds the notion that dentistry is making no serious effort to stem the tide of dental disease in the community. Answering its own question, the *Journal* describes, as quoted below, the organization of dental work in the public schools of New York City as one instance of what dentistry is accomplishing in the field.

In New York City dental care is being provided for a large number of indigent school children, the project being administered in a bureau of the Health Department and financed by the city. (WPA also contributes a considerable sum toward the maintenance of this work.) Far from this work being regarded as detrimental to the best interests of dentistry and of the individual dentists engaged in the work, the consensus of opinion of those familiar with the work is that it is meritorious in itself, and helpful both in terms of public health and of the standing and well-being of the dental profession. Furthermore, positions in this service, which are filled from civil service lists, are sought by dentists of ability and standing in the profession. Such a system surely contains within itself the germs of a plant of larger growth that can flower with benefit to all without at the same time choking out, or interfering with, the proper growth of private practice for the well-to-do, or the orderly and necessary development of dental science and education.

This is an example of teamwork between the profession and the city. The program has been developed with the assistance of successive advisory committees of distinguished dentists in New York, who have contributed their services without remuneration, and is being carried out by a devoted band of dentists and dental hygienists, who serve with high spirit at a minimum wage. These members of the dental profession and of the dental hygienists' profession and many, many others doing similar work in other parts of the country refute the implications of the editorial in the *Philadelphia Record*.

1. Editorial, *New York J. Dent.*, 7:238 and 242, September 1937.

Critics of the dental profession may be interested in figures of accomplishment (from records of the Dental Division) in New York City furnished by Harry Strusser, D.D.S., chief of the Dental Division of the Bureau of Child Hygiene of the New York City Health Department. The figures given below show not only the advancing accomplishments of the dental division as regards the number of children with dental treatment completed by dentists in the division, but also the effectiveness of the educational work, done largely by the dental hygienists, which has resulted in so large a number of children whose parents could afford it being taken to the private dentist for complete dental care.

Approximately there are about one million (1,000,000) children in the public and parochial elementary schools. Our experience has been that 50 per cent of the children are eligible for free service (those cared for by Home Relief, welfare agencies and those in the low income brackets). These figures are derived from actual services rendered in 139—100 per cent Good Teeth Classes in the January and June terms of this year.

Registration in above classes	4,842
Children cared for by Health Dept. clinics	2,379
Children referred and cared for by private dentist	2,370
Number not needing treatment	93

Not the least interesting or significant feature of these figures is the statement that in New York City the experience of the dental division shows that 50 per cent of the public and parochial school children are eligible for free care. This would seem to indicate that 20 per cent out of the 70 per cent mentioned in the editorial in the *Philadelphia Record* could have dental care if they would only seek it. This means the necessity of developing the dental public health educational program along with the treatment program. And this must, in the final analysis, be the job of the state dental health officers at whom the *Philadelphia Record* scoffs.

COUNCIL ON DENTAL THERAPEUTICS

ACCEPTED DENTAL REMEDIES

The following articles have been accepted as conforming to the rules of the Council on Dental Therapeutics of the American Dental Association. The Council wishes dentists to understand that the admission of an article does not imply a recommendation. A copy of the rules that govern the Council in the consideration of articles will be sent on request.

SAMUEL M. GORDON, *Secretary.*

MERCURY AND MERCURIC COMPOUNDS*

Metaphen Germicidal Solution: 1 part Metaphen dissolved in 2,500 parts of water containing sodium hydroxide, U.S.P., 0.81 gm.; sodium carbonate, monohydrated, 12.5 gm.; sodium silicate liquid (40° Bé), 30 gm.; ethylene glycol, 500 gm., and benzyl alcohol, 100 gm.

Manufactured by the Abbott Laboratories, North Chicago, Ill.

HYPOCHLORITES AND HYPOCHLORITE SUBSTANCES†

Solution of Sodium Hypochlorite-Merck: A brand of Solution of Sodium Hypochlorite, U.S.P.

Manufactured by Merck & Co., Inc., Rahway, N. J. No U. S. patents or trademarks.

CALCIUM COMPOUNDS‡

Calcium Hydroxide-Merck: A brand of calcium hydroxide, U.S.P.

Manufactured by Merck & Co., Inc., Rahway, N. J. No U. S. patents or trademarks.

LOCAL ANESTHETICS§

Procaine HCl Solution 2% with Epinephrin 1:25,000-Burkwood: Each cubic centimeter is said to contain procaine HCl (U.S.P.), 0.02 gm.; epinephrine, 0.045 mg.; sodium bisulfite, 0.002 gm.; sodium chloride, 0.005 gm.; potassium chloride, 0.0004 gm., and calcium chloride, 0.0002 gm.

Manufactured by Burkwood Chemical Co., New York City. No U. S. patent or trademark.

Procaine HCl Solution 2% with Epinephrin 1:25,000-Burkwood in Cartridges.

Procaine HCl Solution 2% with Epinephrin 1:50,000-Burkwood: Each cubic centimeter is said to contain procaine HCl (U.S.P.), 0.02 gm.; epinephrine, 0.020 mg.; sodium bisulfite, 0.002 gm.; sodium chloride, 0.005 gm.; potassium choride, 0.0004 gm., and calcium chloride, 0.0002 gm.

Manufactured by Burkwood Chemical Co., New York City. No U. S. patent or trademark.

Procaine HCl Solution 2% with Epinephrin 1:50,000-Burkwood in Cartridges.

*A.D.R. 1937, p. 153.
†A.D.R. 1937, p. 141.
‡A.D.R. 1937, p. 84.
§A.D.R. 1937, p. 36.

PRACTICE IN PARAGRAPHS

This department is intended for busy readers. It aims to tell a vivid story in a few words. Items should be of a practical character, and free from padding—not more than a paragraph or two. We exact no limit, but two hundred words can tell most of these stories. Send in your ideas; they will be welcome.

To Loosen Forceps—Aromatic spirits of ammonia will loosen the tightest forceps.—*A. M. Stinson, Stewartstown, Pa.*

Picric Acid for Burns—A small bottle of saturated solution of picric acid should be kept in the laboratory for use in burns, as its use gives immediate relief and helps to avoid many sore fingers.—*Claude A. Moore, Lexington, Miss.*

Setting Inlay—In setting a small gingival inlay, necessary removal from the cavity should be made with warm sticky wax on a wood applicator. The inlay can be set back in place with precision when cemented.—*Claude A. Moore, Lexington, Miss.*

Boxing Material for Hydrocolloid Impressions—An inch and a half gummed paper machine tape makes a good boxing material for hydrocolloid impressions as wax will not stick to them.—*A. M. Stinson, Stewartstown, Pa.*

Peace of Mind—Before leaving your office for the night, put it in condition, then forget it. Do not take tomorrow's worries home with you.—*Charles C. Norris, Oshkosh, Wis.*

Reality Vs. Opinion—Are you a good dentist? You may think that in reality you are, but what actually is your patient's opinion? Patients who pay, having the right to choose and say, are logical judges. From a financial standpoint, an economical point of view or the bread and butter angle, no dentist is one bit better than his patients' opinion of him. All technic and skill are in vain with "doubting Thomases." Patients must come before skill can be shown. If dentists hurt too much, patients may not come so often, if at all. Fair skill with "patient's appeal" is better than knowing nearly everything about nearly everything else, and the patient going across the street. The dental society, essay, literary contribution or clinic do not determine your patients' estimates of your worth. Patients know little about your inlays unless you can place them in their teeth.—*Herbert Ely Williams, Red Bank, N. J.*

After Five Years—Nine out of ten silicate fillings show deterioration in Class 5 lower cavities. The dryer the field, the more pronounced the defects appear. After the rubber dam is applied, the filling often looks still worse. Gold foil belongs in this class of cavity. Silicates have come to stay and are useful, but not in Class 5 lower cavities, especially where acidity prevails. The same condition which caused the original cavity is prone to deteriorate a nonpermanent filling. When a patient arrives having had gold foil fillings in these Class 5 cavities for fifteen or twenty years and demands more gold foil, what will our answer be? With the advance of science and improvements in dentistry, when the dentist declares he does not use a permanent filling material, how can a patient be convinced that dentistry, or rather the dentist, has really advanced after all?—*Herbert Ely Williams, Red Bank, N. J.*

Wax Pattern Preparation for Carmichael Abutments (Three-Quarter Crowns or Hoods) on Anterior Teeth—Levington Method—While standard inlay wax is satisfactory for making abutment patterns on the boxlike preparations on the posterior teeth, it is difficult to adapt it to the three-quarter preparations on the wedge-shaped anterior teeth. To make wax patterns for anterior three-quarter preparations, the die is prepared and articulated in the usual manner. The pattern is started with two thicknesses of 28-gage sheet casting wax, such as that used for making patterns of removable bridges. With scissors, the sheet wax is trimmed to approximate size, warmed over a flame and adapted to the die with a piece of rubber dam, delicate spatula and sharp knife. With the heated spatula, standard inlay wax is added until the pattern is built up to the desired thickness, shape and contact. For pin preparations, the sheet wax is first adapted to the die and the pins are warmed and inserted in the holes. The procedure is then as described above, and spruing and casting is carried out in the usual manner.—*Herbert Levington, Savannah, Ga.*

Technic of Subcutaneous Injection—Subcutaneous injection of animal serum such as hemoplastin or thromboplastin has been found an efficacious means of preventing bleeding. The technic of this procedure is as follows: Because dental and oral surgeons usually operate while standing in front and to right of the patient, the patient's right arm is most accessible and convenient for subcutaneous injection. The arm is exposed; the skin in the biceps region is washed off with alcohol, and iodine is applied. Then the skin is covered with a piece of sterile gauze. Two cubic centimeters of animal serum are drawn up into a sterile 3 cubic centimeter glass syringe, the needle of which has been previously sterilized, and the balance of the syringe is then filled with Ringer's solution. The needle is sterilized once more by passing it over an alcohol flame. The epidermis is quickly pricked and the contents of the barrel slowly injected, care being taken to expel all the air from the syringe before the needle is inserted. After the solution is deposited, the needle is withdrawn and a piece of adhesive plaster is applied over the puncture, where it is held by slight pressure from a pad of gauze. It is advisable to remove the iodine from the skin carefully with alcohol before the patient is dismissed. This injection is a very simple procedure and, when followed step by step as above described, is readily performed by any operator in his own office, with excellent results. To remove the patient to a hospital for this purpose, as some advocate, is absolutely unnecessary.—*James L. Zemsky, 147 Fourth Ave., New York City.*

Teeth and Their Significance in Forensic Medicine, with Special Regard to the Identification of Corpses—For the legal expert, the effects of various chemicals on the teeth are of importance, especially those of lead, quicksilver, copper, iron, phosphorus, arensic, iodine and acids. The principal injuries to the teeth arising from different trades must be considered. Here are a few of them: the shoemaker, the players on wind instruments, the tailor, the glass-maker and the bead-blower, from which the injuries are either the result of the work or the result of negligence. The teeth of smokers, too, are often worn in a characteristic manner by a pipe or cigar-holder, in addition to being more or less discolored. In this connection, the murder case in which a St. Petersburg banker was assassinated occurs to me. His murder was discovered through a cigar holder. The typical impressions of his upper incisors fitted perfectly into the corresponding marks on the holder. The knowledge of the change that may be produced in the teeth by professional or chemical influences is very important to the expert in establishing identity. The bearer of the defect is often ignorant of these influences, so that to a certain extent they become his betrayers. The professional injuries to the sugar-workers and sugar-bakers, due to the conversion of mild into lactic acid, also deserve mention.—*Henry Schirnding, in M. Press and Circular.*

INCIDENTS OF PRACTICE

An Unusual Anomaly

By I. I. Kaplin, Chicago, Ill.

Figure 1 shows a tooth that I extracted from the nose of a patient and Figure 2

Fig. 1

Fig. 2

the location of the tooth before removal. The patient was sixty-five years of age.

1579 Milwaukee Avenue.

A Case of Resorption of Middle Third of a Root

By Meyer Klatsky, D.D.S., New York City

In our routine examination of x-ray series of teeth, we have come across the following rare and interesting case, showing resorption of the middle third of an upper right central incisor root.

R. I., a woman, aged forty-four, about ten years ago received an injury in the

anterior maxillary region involving the right central incisor. The tooth was loose, but tightened within a short time. Five years later, the patient noticed a swelling in the same region, which was lanced by a dentist. Since then, it had presented no further complications.

Clinical examination does not reveal any pathologic symptoms. The tooth is held firmly in its socket, has the color of a vital tooth and shows other signs of vitality by responding to thermal changes and electrical pulp testing. No other tissue changes are to be observed clinically except a pyorrheic condition, which involves all the teeth.

Authoritative opinion on the prognosis and treatment of this very baffling case would be greatly appreciated.

401 Broadway.

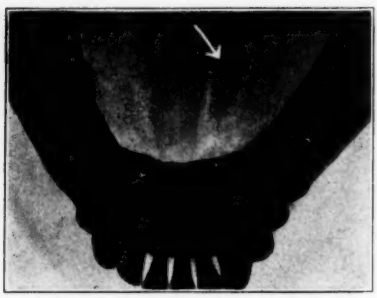
Salivary Calculus: Report of a Case

By W. I. Jones, D.D.S., Columbus, Ohio

The following case illustrates some of the complications that may follow the extraction of teeth and emphasizes the necessity for a correct diagnosis of lesions in or around the oral cavity even though the teeth may not be directly involved.

REPORT OF CASE

History.—Mr. M. consulted his physician, because of a swelling in the submaxillary triangle on the left side of the neck. The physician discovered a decayed third molar in the lower jaw of the affected side and sent him to his dentist, who extracted the tooth. Two days later, he returned to the dentist with an acute exacerbation of the previous symptoms: an increased swelling, trismus and hardening of the submaxillary and lingual glands extending into the floor of the mouth, sharp stabbing pains on swallowing, and an occasional discharge of saliva and pus into the mouth. The patient was then referred to me for treatment.



Examination.—A careful physical examination of the tooth socket and the tissues immediately adjacent to it, including the taking of small films, together with a lateral roentgenogram of the entire mandible and submaxillary region, disclosed no pathosis and failed to demonstrate the presence of a stone. However, when the history of the case was taken, three symptoms were complained of that were very significant and which led me to suspect the presence of a salivary calculus: 1. The swelling was of long standing (about twelve years). 2. The swelling came and went intermittently. 3. The sight or odor of food produced a sense of fullness in the region of the sublingual gland and caused pain to a degree that eating was an ordeal.

Treatment.—The patient was treated by applying hot moist compresses to the outside of the face and irrigating the mouth frequently with hot boric acid solution. After twenty-four hours, the trismus and swelling had subsided enough to permit the introduction of a film, 2½ by 3 inches, into the mouth on a plane with the occlusal surface of the lower teeth. In this way, a roentgenogram of the floor of the mouth was obtained, disclosing a radiopaque area in the region of the submaxillary gland about 2 inches posteriorly to the opening of Wharton's duct, as shown in the illustration. This proved to be a salivary calculus, the cause of the intermittent swelling and pain during a period of over twelve years. Under a local anesthetic, the stone was removed by introducing a probe into the duct until the calculus could be felt. The mucous membrane together with the probe was grasped with artery forceps and an incision was made through the mucous membrane and the wall of the duct down to the calculus. The stone was removed without fragmentation.

The probe used was made of stainless steel wire, gage 23, with the head 0.032 inch in diameter. It is advisable to have several probes of various sizes, as it is important to enter and follow the duct to its beginning in the gland. In this case, the calculus was almost within the body of the submaxillary gland, and also it is difficult to judge with accuracy from a roentgenogram alone the depth of the stone in the tissue.

Outcome.—Recovery was rapid and uneventful. The swelling and pain quickly subsided and in three months there has been no return of untoward symptoms.

327 East State Street.

Ludwig's Angina: Report of a Case

By Joseph Kussy, Ph.G., D.D.S., Newark, N. J.

This case is being reported because of the remarkable course it ran with its many ramifications. Seldom do we experience such a favorable termination of so serious an infection as in this, a case unanimously viewed as most probably fatal by all con-

sultants and others in the hospital who watched it.

The blood chemistry, with the chills and characteristic temperature picture which followed them (105°-106° F.) would usually be indicative of postoperative venous emboli or a definite septicemia, and yet at the age of sixty-nine this patient made a complete recovery.

REPORT OF CASE

History.—Mrs. W. was admitted to Newark Beth Israel Hospital, August 2, 1937, with pain in the throat and slight swelling of the left submaxillary area. The patient stated that she had visited her dentist three days previously because of pain in the left lower molar. The dentist did not inject an anesthetic, but drilled into the pulp chamber. There was no relief, and the dentist then noticed redness and swelling of the neck. He referred the patient to her physician, who advised immediate hospitalization.

Examination.—There was no polydipsia, polyuria or polyphagia, and no illness nor loss of weight previous to this illness. The blood pressure was: systolic, 170; diastolic, 100.

Head: The eyes reacted normally to light and there was no ptosis. The ears presented no areas of tenderness and no discharge. Examination of the neck revealed hard infiltration and cellulitis down to the sternum, seemingly beginning at the lower border of the mandible on the left side.

Mouth: There was difficulty in opening the mouth. Examination revealed several carious teeth, and a tongue moist and raised. The odor of the breath was fetid. The tonsils and pharynx were clear.

Chest: The lungs were negative to percussion and auscultation. The heart was negative and the abdomen normal. The reflexes were normal.

Roentgen-ray examination revealed an infected left lower molar.

Treatment.—I was called in on the day of admission and had the patient prepared for operation. The blood sugar was 150 mg. per hundred cubic centimeters of blood and therefore insulin and glucose were given immediately; a procedure which was continued for some time after operation. The operation was delayed for two days in an effort to obtain fluctuation by means of small hot flaxseed poultices.

Operation (August 7).—Two deep incisions were made, one on each side of the median line of the neck. With large hemostats, we burrowed through underneath the angle of the jaw on each side and up to the base of the tongue. Free pus was obtained. A channel was made connecting the two incisions subdermically and a large rubber tissue drain inserted extending through and beyond both openings. Hot magnesium sulfate wet dressings were prescribed to be used continuously about the neck. The infected molar had been removed the day previous.

Laboratory Findings.—The culture of pus from the incision showed hemolytic and nonhemolytic streptococci, diphtheroids and staphylococci; while that from the mouth showed in addition *M. catarrhalis* and some anaerobic organisms (probably Vincent's.)

Course.—Despite the free drainage and irrigation, the patient grew worse, and two days after the operation, a well-known throat specialist was called into consultation because of the patient's difficulty in swallowing and respiration. He advised another incision (linear) between the two previously made and upward to the base of the tongue. This brought no flow of pus.

There was no improvement, and the following day the patient had two chills followed by temperatures of 105 and 106.2°. Frequent doses of sulfanilamide were now given in addition to injections of prontosil. Later, the prontosil was omitted. The patient was also given two blood transfusions, one with citrates.

Outcome.—The change for the better was gradual, the temperature reaching 103° for several days, then 102°, then 100° for three days. The patient was discharged August 28.

Here was a case with no favorable symptoms developing throughout its course, with hypertension, diabetes, cyanosis, dyspnea and inability to swallow, and terminating in complete recovery.

88 Clinton Avenue.

CURRENT LITERATURE

Radium Treatment of Epithelioma of the Lip

By WENDELL C. HALL

Two hundred and eighty-five cases of epithelioma of the lip treated in the radiologic department of the Hospital of the University of Pennsylvania since 1908 are reviewed and the following observations are made: Irritation and exposure to weather appeared to be predisposing factors. Farmers, laborers, carpenters, incessant pipe smokers, persons with leukoplakia and those with jagged teeth sought treatment most often. The onset of the lesion could be traced to trauma in a few instances. A family history of malignancy appeared to be of no significance. Most patients were over fifty years old, although the youngest was nineteen. The author discusses the evolution of the treatment of such lesions from 1908 to date. A summary of results show ten local recurrences, two of which occurred during the past ten years. Thirty-seven patients died directly as a result of the malignancy, and 95 per cent of these died after metastasis had developed, only 2 in the group dying from the local lesion alone. Less than 5 per cent of the patients who developed metastasis were cured, and it may safely be said that if a patient has moderately advanced metastasis to the nodes in the neck when he first seeks treatment, the chance of a cure is slight. The author recommends very conservative treatment of patients without metastasis and warns that palpable nodes present in the neck in many cases are not metastatic, but disappear shortly after treatment of the primary lesion. Of 258 patients free of metastasis at their first visit, 3 per cent developed metastasis in the neck nine months or less after the cure of the local lesion. The author therefore states that if the local lesion is cured before metastasis develops, the likelihood of metastasis appearing later is somewhat remote. Irradiation and operative treatment of fixed metastatic nodes did not have a favorable response, but treatment of discrete nodes uncovered surgically and with radon or radium followed by the roentgen rays did. Extensive mass metastases should be treated only by external irradiation for palliation.—*Am. J. Roentgenol. & Rad. Therap.*, 38:116-121, July 1937.

GRANT VAN HUYSEN.

Roentgen-Ray Therapy in Fibrous Ankylosis of the Jaw

By A. R. MACKENZIE

TWENTY-NINE cases of articular type, fibrous, non-bony ankylosis of the mandible, were treated, with only one partial failure. The duration of the ankylosis ranged from three months to three years, in patients nine to thirty-four years of age. The eight bilateral cases gave previous histories of infection of the tonsils with extensive soft tissue infection; whereas, the twenty-one unilateral cases gave histories of infections from carious teeth with surgical interference previous to roentgen-ray therapy, and in nearly all of the cases nerve block anesthesia was used. The author gives two equally good therapeutic technics, one of them consisting of the following: 200 kv., 0.25 mm. copper filter, 50 cm. distance, suitable cone, 350 roentgens, average number of treatments given, 205, over an interval of from ten days to two weeks. Roentgen-ray therapy is not advocated as a substitute for surgical intervention, but as a method of primary choice because, as the author states, scar tissue formation resulting from surgical operation is especially marked in certain individuals, and successful results were obtained in the treatment of this series.—*South. M. J.*, 30:816, August 1937.

GRANT VAN HUYSEN.

Tumor Lipids. The Comparative Lipid Content of the Periphery and Center.

By F. L. HAVEN

THE periphery of rat carcinosarcoma 256 consists of non-necrotic, growing tissue. The center consists of necrotic, non-growing tissue. The average phospholipid content of the periphery is twice that of the center. The center contains much more cholesterol, neu-

tral fat and water than the periphery. Comparison of the lipid content of the periphery and the content of the center lends support to the view that cholesterol ester and neutral fat are formed from the fatty acids arising from the decomposition of phospholipid.—*Am. J. Cancer,* **29**:57, January 1937.

VIRGIL D. CHEYNE.

Phospholipid Metabolism of Tumors.

WORK done by other authors proves that malignant tumors contain larger amounts of both phospholipid and cholesterol than benign tumors. Feeding elaidin to differentiate between "metabolic phospholipid" or functional class and "non-metabolic" or cellular structure class indicates that the phospholipids of tumor are mainly of the non-metabolic type, having to do with cellular structure rather than with burning of fatty acids for energy.—*J. Biol. Chem.*, **118**:111, March 1937.

VIRGIL D. CHEYNE.

Recovery of Rats upon Re-Feeding After Prolonged Suppression of Growth by Underfeeding.

By C. M. JACKSON

THERE is still some uncertainty as to whether prolonged inanition may so injure the young organism as to render it incapable of later growth to normal adult size. Underfeeding young rats produced a high mortality. Surviving test rats were fully re-fed and at first grew with abnormal rapidity. Soon the growth rate lagged, however, and the final average dwarfing remained about 16 per cent below that of the normal controls. Breeding tests showed even better reproductive performance in the surviving test rats than in the normal controls. At necropsy, findings were significantly lower in the test rats, but in general nearly normal for corresponding body weight.—*Anat. Rec.* **68**:371, June 25, 1937.

VIRGIL D. CHEYNE.

Lipolytic Activity of Lactobacillus Acidophilus

By B. LUBNER

BERRY'S method for detection of microbial lipase (streaking agar plate to which butter fat has been added and incubating, then flooding with saturated solution of copper sulfate yielding bluish green insoluble copper soap) is used by the author to differentiate strains of *L. acidophilus*. Of nineteen strains investigated, twelve gave positive lipase reactions. No attempt was made to differentiate oral and intestinal strains on this basis.—*J. Lab. and Clin. Med.*, **22**:1183, August 1937.

HAMILTON ROBINSON.

The Effect of Facial Sympathectomy on Buccal Leukoplakia

By J. C. DEL CAMPO

FIFTEEN days after preliminary removal of the submaxillary glands for an epithelioma on a leukoplakia patch, it was noticed that the epitheliomatous area could be clearly defined. It was concluded that the change resulted from interference with the sympathetic supply. An ulcerated leukoplakia area of the lip showed considerable improvement two months after stripping of the nerves from the facial artery. The author hesitates to predict the permanency of his results. Stajano, a discussor, gave his experience with hypogastric sympathectomy for leukoplakia of the vulva. —*Rev. Uruguaya d. Derm. y. Sif.*, **1**:144, 1936; abstr. *Brit. J. Derm. & Syph.* **49**:288, June 1937.

HAMILTON ROBINSON.

Fifty Cases of Actinomycosis and the Results of Vaccine Therapy

By P. NEGRONI

THE sites of fifty cases of actinomycosis seen over a six-year period in Buenos Aires were: cervico-facial, 50 per cent; temporofacial, 12 per cent; lower extremities, 14 per cent; abdominal, 8 per cent, and one case each on the wrist and in the anterior chamber of the eye. Anaerobic actinomyces were obtained from the lesions and infection could be traced to actinomyces associated with bacterial infection in foci located in the teeth, tonsils and respiratory and intestinal tracts. Aerobic cultures were obtained from the lesions on the lower extremity and in the eye, probably caused by external tissue damage, as thorn scratches. Thirty-six cases, mostly of five-years' duration, were treated with heterovaccines (filtrates from cultures), and in 55 per cent of these (twenty cases) recovery was complete. Marked improvement was noted in six cases, six did not respond and four cases were not followed.—*Rev. Bacteriol. d. Dept. Nac. Hig.*, **7**, July 1936; abstr. *J. Trop. Med. & Hyg.*, **40**:109, May 1, 1937.

HAMILTON ROBINSON.

The Nervous Secretion of Saliva

By W. Gantt

Although it has been experimentally shown that pancreatic and gastric secretions vary directly with the weight of the food ingested, there has been no previous conclusive experimentation showing the relation of the volume of parotid saliva to the weight of the food intake. The present series of experiments are a résumé of 8,000 recorded measurements in twelve dogs over a period of five years. A uniform chronic parotid fistula of the left gland and systematic feeding increased the accuracy of the results obtained. It was found that there is a definite relation between the amount of secretion and the amount of food intake. Also, the rate of eating has but a slight effect on the amount of salivary secretion. It is considerably faster for large than for small quantities of food. Lastly, it was demonstrated that for a specific food intake the secretion was practically the same. —*Am. J. Physiol.* **119**:493, July 1, 1937.

J. Volker.

Anoxia in Anesthesia

By T. Harris

Secondary saturation with the use of nitrous oxide has come to be included as a routine part of the nitrous oxide anesthesia technic in America. This practice causes a resultant tissue anoxia. The amount of cyanosis present is used as an indicator of the degree of anoxemia. In a polycythemic patient and an anemic patient, the accuracy of the indicating factor must be discredited. Furthermore, anoxia must be considered a threat to normal cell activity, as it increases the burden of the body tissue, and is not an essential corollary of anesthesia.—*Brit. J. Anes.* **14**:141, July 1937.

J. Volker.

Hereditary Failure of Eruption of the Permanent Dentition.

Case reports of mother and son are given. The son, aged sixteen, had complained of pain in the upper jaw. Roentgen-ray examination revealed twenty-five impacted teeth. In addition, bony union had not taken place in the symphysis. The mother, aged forty-five, presented a similar condition. Roentgenograms of her mouth revealed twenty-seven unerupted teeth. Both patients were of retarded physical development, suggesting pituitary dysfunction. An only daughter and the woman's mother were normal. The woman's father was dead.—*Brit. D. J.*, **63**:205, August 16, 1937.

Virgil D. Cheyne.

Microhardness Studies on Transparent Dentin

By H. C. Hodge

Transparent areas are frequently found in the dentin; e. g., (a) the periphery under the enamel; (b) the root-tip, especially in pyorrhea, and (c) the tip of the pulp horn in cases of marked attrition. In some cases, the presence of the zone has been described under caries. The present knowledge of transparent dentin does not permit a single description of either its histologic structure or its source. Vertical polarized light is shown to be a very useful agent in locating areas of transparent dentin. The average microhardness of transparent secondary dentin is about 20 per cent less than that of normal coronal dentin in the same tooth. Transparent peripheral dentin near the dentino-enamel junction is of the same hardness as the nearby coronal dentin. —*Brit. D. J.*, **63**:181, August 16, 1937.

Virgil D. Cheyne.

Diagnosis of Dental Infection by Short Wave Provocation

Gutzeit and Kuchlin describe a method of application of short waves to the dental root which permits the differentiation of infectious foci that cause systemic disorders or diseases in other organs from those which are localized and not connected with the circulatory system. In the presence of the first type of focus, the sedimentation speed of the erythrocytes is noticeably accelerated from two to four hours after a provocative irradiation with short waves; whereas the irradiation of the second type of focus does not have such an effect. Such a differentiation of the active and the inactive foci has not been possible, for neither the clinical nor the roentgenologic examination of the teeth permits such a qualitative differentiation. The recognition of the active foci prevents the blind, radical removal of all suspected foci and thus overcomes the chief objection of the conservative physicians to the radical treatment of infectious foci. The possibility of identifying the offensive foci prevents unnecessary crippling of the dental apparatus. The

electrodes used for the short wave irradiation of the dental roots are 2 by 3 cm. in size. They are applied on the buccal side of the tooth. According to the statement of the patients, the short waves produced a pleasant feeling. Pains or burning sensations should not develop if the apparatus is intact. The authors described their experiences with the test on healthy and diseased teeth.—*München. Med. Wchnschr.*, **84**:961, June 18, 1937; from *J.A.M.A.*, **109**:543, August 14, 1937.

M. K. Hine.

Electrogalvanism from Dental Fillings

To the Editor: Will you kindly inform me whether a bridge made of platinum and white gold, fitting just above two teeth inlayed with gold, can cause an electrolytic action. The area at the side of the tongue adjacent to the bridge is complained of by the patient as producing queer annoying sensations. I should particularly like to know whether such a condition, if prolonged, could be related to the development of a malignant lesion.

M. D., Florida.

Answer: Electrogalvanism in the oral cavity between dissimilar metallic restorations is a long established fact. Within recent years, research by different investigators and clinical reports published in various medical and dental journals have called attention to the possibility of annoying subjective symptoms and visible pathologic lesions such as localized ulcers and leukoplakias, with subsequent malignant growths, bearing a close relationship to the electrolysis between dissimilar dental restorations.

The degree of irritation and pathologic change depends on numerous factors, though chiefly on the relative positions which the different metals occupy in the standard electromotive series of metals published in college textbooks on physics or dental metallurgy.

In the case in question there is an upper bridge made of platinum and white gold. Immediately below there are two teeth with gold inlays. Pure platinum and gold are electropotentially closely related, but in dental constructions for enhancing their value each is alloyed with other agents. Gold is bleached by the addition of nickel or silver. Most dental gold also contains from 10 to 15 per cent of copper to give it hardness. Both nickel and copper bear a comparatively wide electropotential relationship to pure gold or platinum; hence, when they are immersed in saliva, a good electrolyte, the elemental factors for a galvanic current exist.

An approximate measurement of current can be made with a delicate galvanometer or micro-ammeter. The most common symptoms of galvanic irritation in the mouth are usually first felt on the margins of the tongue, or an occasional metallic taste. Therefore, if other possible etiologic factors have been eliminated in this case, it is probable that the patient is being annoyed by electrogalvanism between his dissimilar dental restorations. If this conclusion is correct, the patient will be relieved if one or both constructions are removed and replaced with metals electropotentially balanced.

More explicit information on this subject may be found in:

Lain, E. S.: Electrogalvanic Lesions of the Oral Cavity Produced by Metallic Dentures, J.A.M.A. **100**:717 (March 11) 1933.

Macdonald, W. J.: Chemical and Electrogalvanic Burns of the Tongue, New England M. J. **211**:585 (Sept.) 1934.

Lain, E. S., and Caughron, G. S.: Electrogalvanic Phenomena of the Oral Cavity Caused by Dissimilar Metallic Restorations, J.A.D.A. **23**:1641 (Sept.) 1936. — Queries and Minor Notes, *J.A.M.A.*, **109**:526, August 14, 1937.

M. K. Hine.

BIBLIOGRAPHICAL

BOOK REVIEWS

"Principles of Full Denture Prosthesis"

By E. Wilfred Fish, M.D. Manch., D. D.Sc. Melb., D.Sc. Lond. Honorary Dental Surgeon and Lecturer in Dental Prosthesis, Royal Dental Hospital and School of Dental Surgery, London; Assistant Honorary Dental Surgeon, St. Mary's Hospital, Paddington. 116 pages, 48 illustrations and stereoscopic plates. Third edition, revised. Price 12 shillings and 6 pence. Published by John Bale, Sons & Curnow, Ltd., London.

To those who are at all familiar with the writings of Dr. Fish, it is unnecessary to say in advance that this book is well written. In addition to this, there is a breadth of perception that is most refreshing. The subject is full dentures, but the author in his introduction makes the following significant statement: "It should be a very rare event indeed to render any intelligent patient completely edentulous. Almost any natural tooth will stabilize a denture infinitely better than all the applied lore of full denture craftmanship."

The strength of this observation is only an indication of the general tenor of the book. Dr. Fish writes with clarity and a thorough grasp of the subject.

The author studies with some care the lines and direction of force of the dentures in the process of mastication, and analyzes the effect on the consequent stability of the dentures. He also studies the musculature of the cheek and lips as this affects the comfortable wearing of dentures.

The relationship of the upper to the lower occlusal surfaces as it affects the efficiency of the process of mastication comes in for careful study, and the keynote of the whole volume seems to be the most effective service with the greatest comfort.

The illustrations are exceptionally well done on the finest paper, all of which makes the volume most attractive.

This little book is a clear and concise treatment of the subject, and it merits the utmost commendation.

"Synopsis of Pediatrics"

By John Zahorsky, A.B., M.D., F.A.C.P., Professor of Pediatrics and Director of the Department of Pediatrics, St. Louis University School of Medicine; Fellow of the American Academy of Pediatrics, etc. Assisted by T. S. Zahorsky, B.S., M.D., Instructor in Pediatrics, St. Louis University School of Medicine, Etc. Second Edition. St. Louis: The C. V. Mosby Company, 1937. Price $4.

A handbook for the medical student filled with descriptions of symptoms, signs, treatment and the clinical appearance of numerous children's diseases. It offers much clinical information that can be very helpful to the general practitioner. Symptoms of many diseases of the oral cavity, throat, etc., are given in a clear manner and pictured, too, so that the book may be of practical aid to the dentist in recognizing common mouth diseases.

"Personal Hygiene"

By C. E. Turner, M.A., Dr. P.H., Professor of Biology and Public Health in the Massachusetts Institute of Technology; Major, Sanitary Corps, U. S. A. (Reserve). 84 text illustrations and 3 color plates. St. Louis: The C. V. Mosby Company, 1937. Price $2.25.

This book treats in a practical and understandable manner all phases of personal hygiene, and although intended as a text, it can be read with much profit by the layman. The chapter on the teeth is not extensive, but outlines a sensible program for oral hygiene and the care of the teeth.

"Year Book of the American Pharmaceutical Association, 1934. Vol. 23."

Containing the Seventy-Seventh Annual Report of the Progress of Pharmacy, the Roster, a list of Former Officers, the Constitution, By-Laws, Articles of Incorporation, Code of Ethics, History of Funds, Treasurer's Report and Roll of Members.

Published by the American Pharmaceu-

tical Association, Washington, D. C., 1936.

In addition to the above, this Year Book undertakes to report the progress made in pharmacy as represented by the national body; and also includes abstracts of all the worth while articles published in the pharmaceutic literature for the year 1934.

"History of the Human Teeth"

An Introduction to Comparative Dental Anatomy. By Cleveland Sylvester Simkins, Ph.D., Associate Professor of Anatomy, Histology and Embryology, University of Tennessee Medical School. Philadelphia: P. Blakiston's Son & Co., Inc.

This book, comprising 329 pages and 111 illustrations, is a very laudable effort to present in a more readable and interesting manner the study of a phase of dentistry which to the average student is exceedingly drab reading. A knowledge of comparative dental anatomy, however, is quite necessary to the proper understanding of the function, purpose and adaptability of the masticatory apparatus to the present-day needs of the human race. The author has attempted to defossilize figuratively paleontology and he has succeeded admirably. The subject is presented from the dental point of view, and only includes what the author believes should be demanded of the dental student on the subject of comparative dental anatomy.

"Materia Medica, Toxicology and Pharmacognosy"

By William Mansfield, A.M., Phar. D., Dean and Professor of Materia Medica and Toxicology, Union University, Albany College of Pharmacy, Albany, N. Y. With 202 illustrations. St. Louis: The C. V. Mosby Company, 1937. Price $6.75.

"Materia Medica, Toxicology and Pharmacognosy" is a text and reference book on the therapeutics, toxicology, pharmacognosy, and posology of the official drugs of the United States Pharmacopoeia XI and the National Formulary VI. The various groups of drugs are so classified as to permit ready reference to descriptions of the drugs and their sources as a valuable supplement to the official records. It also adds with regard to each drug the source, preparation, properties, uses, dose and toxicology, and should prove an invaluable aid in prescription writing.

"Hemophilia: Clinical and Genetic Aspects"

By Carroll La Fleur Birch, M.D., Assistant Professor of Medicine. Published by the University of Illinois at Urbana. 1937. Price $2.50.

The author has gathered here the medical history of one hundred persons who have been afflicted with hemophilia. These records and the interesting and complete clinical histories accompanying them constitute a distinct contribution to the knowledge of a condition which is met with in its most alarming expression in dentistry.

Dentists who have unknowingly extracted teeth for hemophiliacs have been compelled to study many of the data here presented; and those who have not had such unfortunate experiences can prepare themselves to act intelligently when such an emergency arises, through familiarity with the contents of Dr. Birch's monograph of one hundred and fifty pages.

"Prosthetic Dentistry"

By Norman S. Essig, D.D.S., Philadelphia, Pa., Professor of Prosthetic Dentistry, Temple University School of Dentistry, Philadelphia, Pa. Brooklyn, N. Y.: Dental Items of Interest Publishing Company, 1937. Price $4.

This is the first of a series of "primers" or manuals which the publishers propose presenting to the profession as guides to technical procedures in the different phases of dentistry. Dr. Essig is well and favorably known to the profession as an expert prosthetic technician as well as for his exceptional artistic ability in reproducing the natural appearance of the human denture; and he has here further displayed an exceptional ability as a clinician.

While primarily intended for the student, this book may be of much value as a review reference work for the general practitioner. It should also prove of exceptional value to the technician.

We commend particularly the suggestions of Dr. Essig with relation to the selection, preparation, finishing and staining of artificial teeth in an endeavor to reproduce the natural appearance of the patient.

ANNOUNCEMENTS

ANNOUNCEMENTS must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

CALENDAR OF MEETINGS

American Dental Association, St. Louis, Mo., October 24-28, 1938.

National Board of Dental Examiners, December 6-7.

Academy of Anesthesiology in Oral Surgery, New York City, October 20.

American Society for the Advancement of General Anesthesia in Dentistry, New York City, fourth Monday in March and October.

Five State Postgraduate Clinic, Washington, D. C., March 6-9, 1938.

District of Columbia Dental Society, second and fourth Tuesdays in each month from October to June at the United States Public Health Service Auditorium, Washington.

Greater New York Dental Meeting, New York City, December 6-10.

Greater Philadelphia Annual Meeting, Philadelphia, February 2-4, 1938.

Great Lakes Association of Orthodontists, Cleveland, Ohio, November 1-2.

Northern Illinois Dental Society, La Salle, September 29-30.

American Dental Society of Europe, Stockholm, August 1-3, 1938.

STATE SOCIETIES

November

Florida, at Hollywood (4-6)
Ohio, at Columbus (8-10)
Puerto Rico, at San Juan

December

Hawaii, at Honolulu

April

Wisconsin, at Milwaukee (25-28)

May

North Carolina, at Winston-Salem (2-4)

STATE BOARDS OF DENTAL EXAMINERS

California, at San Francisco, December 6. Kenneth I. Nesbitt, 450 McAllister St., San Francisco, Secretary.

Connecticut, at Hartford, November 30-December 4. Almond J. Cutting, Southington, Recorder.

Indiana, at Indianapolis, October 25. J. M. Hale, Mt. Vernon, Secretary.

Minnesota, at Minneapolis, December 10-16. Paul Hagen, Crookston, Secretary.

New Jersey, December 6-11. Walter A. Wilson, 148 W. State St., Trenton, Secretary.

Ohio, at Columbus, October 25. Morton H. Jones, 1553½ North Fourth St., Columbus, Secretary.

Texas, at Houston, December 13-16. B. Carl Holder, 1009 Nixon Bldg., Corpus Christi, Secretary.

Wisconsin, at Milwaukee, December 13-17. S. F. Donovan, Tomah, Secretary.

WISCONSIN STATE DENTAL SOCIETY

The Wisconsin State Dental Society will hold its next meeting at the Schroeder Hotel, Milwaukee, April 25-28, 1938.

E. E. PARKINSON, *Secretary*,
104 King St.,
Madison.

CONNECTICUT DENTAL COMMISSION

The Connecticut Dental Commission will meet in Hartford, November 30-December 4, for the examination of applicants for license to practice dentistry and dental hygiene and to transact other business. Applications should be in the hands of the recorder at least ten days before the meeting. For application blanks and further information, apply to ALMOND J. CUTTING, *Recorder*,
Southington.

OHIO STATE DENTAL BOARD

The October examination of the Ohio State Dental Board will be held at the College of Dentistry, Ohio State University, Columbus, the week beginning October 25. All applications must be in the hands of the secretary at least ten days before the date of examination. For further information apply to

MORTON H. JONES, *Secretary*,
1553½ North Fourth St.,
Columbus.

TEXAS BOARD OF EXAMINERS

The Texas Board of Dental Examiners will hold its next examination December 13-16 in Houston. There is no reciprocity and no temporary licenses are granted. Applications must be filed at least ten days prior to date of examination. For further information, address B. CARL HOLDER, *Secretary*,
1009 Nixon Bldg.,
Corpus Christi.

DISTRICT OF COLUMBIA DENTAL SOCIETY

The District of Columbia Dental Society

will hold its meetings the second and fourth Tuesdays of every month from October to June, at the United States Public Health Service Auditorium, Constitution Ave. at Nineteenth St., Washington.

DANIEL F. LYNCH, *Secretary*,
1149 Sixteenth St., N. W.,
Washington.

AMERICAN SOCIETY FOR THE ADVANCEMENT OF GENERAL ANESTHESIA IN DENTISTRY

The next meeting of the American Society for the Advancement of General Anesthesia in Dentistry will be held at the Belmont Plaza Hotel, New York City, October 25, at 8:30 p. m., with dinner at 7.

HARRY J. FIELD, *Secretary*,
130 Market St.,
Newark, N. J.

ACADEMY OF ANESTHESIOLOGY IN ORAL SURGERY

The regular meeting of the New York Chapter of the Academy of Anesthesiology in Oral Surgery will be held October 20 at the George Washington Hotel, New York City.

J. M. ESKOW, *Secretary*,
147 Market St.,
Perth Amboy, N. J.

AMERICAN DENTAL SOCIETY OF EUROPE

The next annual meeting of the American Dental Society of Europe will be held in Stockholm, August 1-3, 1938.

K. C. CAMPBELL, *Secretary*,
88 Portland Place,
London, W. I.

THE SOUTHERN SOCIETY OF ORTHODONTISTS

The sixteenth annual meeting of the Southern Society of Orthodontists will be held at the Hotel Cleveland, Spartanburg, S. C., February 7, 1938.

WILLIAM P. WOOD, JR., *Secretary*,
442 W. Lafayette St.,
Tampa, Fla.

PENNSYLVANIA STATE BOARD OF DENTAL EXAMINERS

The Pennsylvania State Board of Dental Examiners shall hold its next examinations at both Philadelphia and Pittsburgh, December 7-11.

W. A. MCCREADY, *Secretary*,
1115 Highland Bldg.,
Pittsburgh.

GREATER PHILADELPHIA ANNUAL MEETING

The Greater Philadelphia annual meeting will be held February 2-4, 1938, in the Benjamin Franklin Hotel, Philadelphia.

ABRAM COHEN, *Chairman of Publicity*,
4727 Rising Sun Ave.,
Philadelphia.

UNITED STATES PATENTS APPLICABLE OR PERTAINING TO DENTISTRY, ISSUED DURING AUGUST 1937

August 3

No. 2,088,839, to DAVID M. CONEY and ZACHARY T. CONEY. Toothbrush.

August 10

No. 2,089,206, to NATHAN HERSHAU. Dental Impression Tray.

No. 2,089,265, to LOUIS KALVIN. Dental Impression Tray and Holder.

No. 2,089,529, to GEORG BEHR. Toothpaste.

No. 2,089,531, to EINAR BERGVE, Toothpaste.

No. 2,089,552, LAURENCE E. HARRISON. Impression Material and Method for Making Impression Material.

No. 2,089,587, to ENRIQUE G. TOUCEDA. Denture.

No. 2,089,715, to ALFRED K. SIMMONS. Apparatus and Method for Taking Dental Impressions.

No. 2,089,845, to MALCOLM W. ATKINS. Dental Compound.

August 17

No. 2,090,144, to ANTHONY PALIMERI and JOHN GUARDINO. Toothbrush.

No. 2,090,358, to JOSEPH F. REITER. Anesthetizing Administering Apparatus.

No. 2,090,437, to NORMAN E. WOLDMAN. Dentifrice.

August 24

No. 2,090,885, to CHARLES HOWARD CLARK. Dental Drilling Instrument.

No. 2,090,904, to EMIL SINGER. Dental Matrix.

No. 2,090,933, to STANLEY G. BOLIN. Device for Positioning Dental X-Ray Films.

No. 2,091,072, to FRANCIS H. GRANT. Apparatus for Making Tooth Backings.

No. 2,091,092, to HORACE HAYMAN BOYLE. Dental Apparatus.

August 31

No. 2,091,511, to BESSIE LONDON. Gum Massaging and Teeth Exercising Device.

No. 2,091,716, to JOHN J. PETTA. Toothbrush.

No. 2,091,885, to JACK H. SAIDEL. Dental Plate Reforming Method and Apparatus Therefor.

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